The Electrical Industry's Weekly Magazine

February 2, 1959

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Abandoned trolley lanes to carry Con Edison's 69-kv cables on bridge

...p 37

Utilities Warned to Order Boilers & Turbines Now or Risk Late Shipments ...p 63

STEVENS RICE GS W
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

Shift in A-Power Policy Expected . . . p 3

Plan to stay ahead... MODERNIZE!

New High in Voltage

230-kv potential TRANSFORMER

NATIONAL ELECTRICAL WEEK
FEBRUARY 8-14, 1959

compact design reduces weight 60%

The new Allis-Chalmers 230-kv instrument transformer marks a new high in voltage for potential transformers using modern design principles. This compact design, which includes the application of better insulating materials and eliminates the use of oil-filled condenser type bushings, results in a weight reduction of 60% less than possible in conventional construction.

Advanced corona-free design in tank and bushing

The entire line of Allis-Chalmers potential transformers, from 24 kv through 230 kv, can withstand long voltage stresses and short-time surge conditions. Internal corners and coil edges are protected by formed insulating channels which fit close to coil surfaces — effectively prohibiting formation of corona and the development of leakage paths. The one-piece high voltage porcelain bushing, integral with the primary winding, incorporates the same corona-free design features used in the transformer.

Easy handling, simplified installation, improved performance in ratio and phase angle, hermetically sealed tanks for less maintenance — for the details of all these features and advantages, contact your A-C man, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

A-C ALLIS-CHALMERS

A-5833

Electrical World

Vol. 151, No. 5 FEBRUARY 2, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

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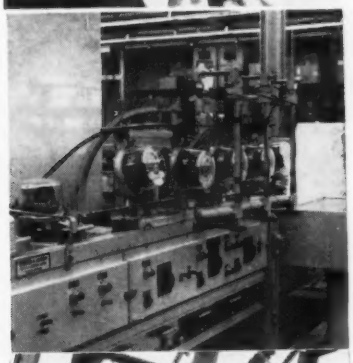

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Order Now or Risk Late Delivery

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Soggy land and heavy reels of Okonite Cable presented a rugged installation problem. But by digging a 4-foot trench, and by "putting the Cat before the truck before the float," Guarantee Electrical Co. laid down two cables simultaneously at three miles per hour. Cables were a 15kv, 3-conductor Okolite-Okoprene submarine power cable and a 24-conductor Okolite-Okoprene submarine control cable designed to assure the continuous water supply essential to plant operation.

"We specified Okonite because...

This tough installation called for top-quality cables to assure continuous plant operation"

"Demanding assignments are 'our meat'," says Arthur Kaspar, Chief Electrical Engineer of Guarantee Electrical Company of St. Louis. "A good example is our recent cable installation for a large plant here in Missouri.

"Our client specified a never-failing, 24-hour-a-day, controlled source of plant water. The best pumping station site was miles from the plant, in low-water marsh land subject to periodic flooding from the Mississippi River—up to 25 feet above river level. One thing was certain . . . this called for really dependable cables for power and for control of the complex pumping station that would supply the water to the plant.

"Another thing was certain, too . . . this was a job for Okonite. Our experience has taught us that Okonite gives maximum insurance and value where dependability in vital circuits is concerned."

Conferences between Mr. Kaspar and Okonite developed the proper cables: unaffected by water, highly resistant to soil conditions and other factors that attack *any* buried or submerged cable, and backed up by Okonite's 78 years of making highest-quality cable.

* * *

For your vital circuits, take a tip from Mr. Kaspar and other leading electrical engineers and specify Okonite. Whatever the installation, when you talk to Okonite you'll get an unprejudiced recommendation for your cable needs because Okonite, *and only Okonite*, makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.

5248

***where there's electrical power... there's* OKONITE CABLE**

When Do We Need A Conference?

My attention has again been called to the fact that our industry is overburdened with meetings and conferences. The principal objection arises not only because of the quantity of meetings but also because of duplication of subject matter.

One question raised is, how many times and in how many places should the same subject be covered? Why should three or four groups arrange separate meetings covering the same general subject matter using the same speakers?

We know that there has been some interest shown in this problem which we covered in a preliminary way in our December 8, 1958 issue in an editorial entitled "Too Many Industry Conferences." But this is such a big and universal problem that we must have more interest in its solution.

Now I would not want to propose a new association of conference chairmen but we might consider just one more conference with a single objective . . . reducing the number of industry conferences.

Fischer Black

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PRE-ASSEMBLED DOUBLE CIRCUIT INTEGRATED SUBSTATION

THE FIRST INTEGRATED SUBSTATION is operating at Thorntown, Indiana . . . developed by the Public Service Company of Indiana, Inc. and Moloney Electric Company . . . designed and built to provide an efficient, economical means of serving outlying areas.

This type of unit has several distinct advantages over conventional methods of substation construction . . .

- Considerably less time is required for erection thereby effecting a saving in field assembly costs and assuring an early in-service date.
- Less handling and storage of materials.
- Engineering and purchasing time are minimized.
- Standard mounting arrangement of the low voltage structure permits replacement of the transformer with a larger unit in the event of future load growth.
- Portability.

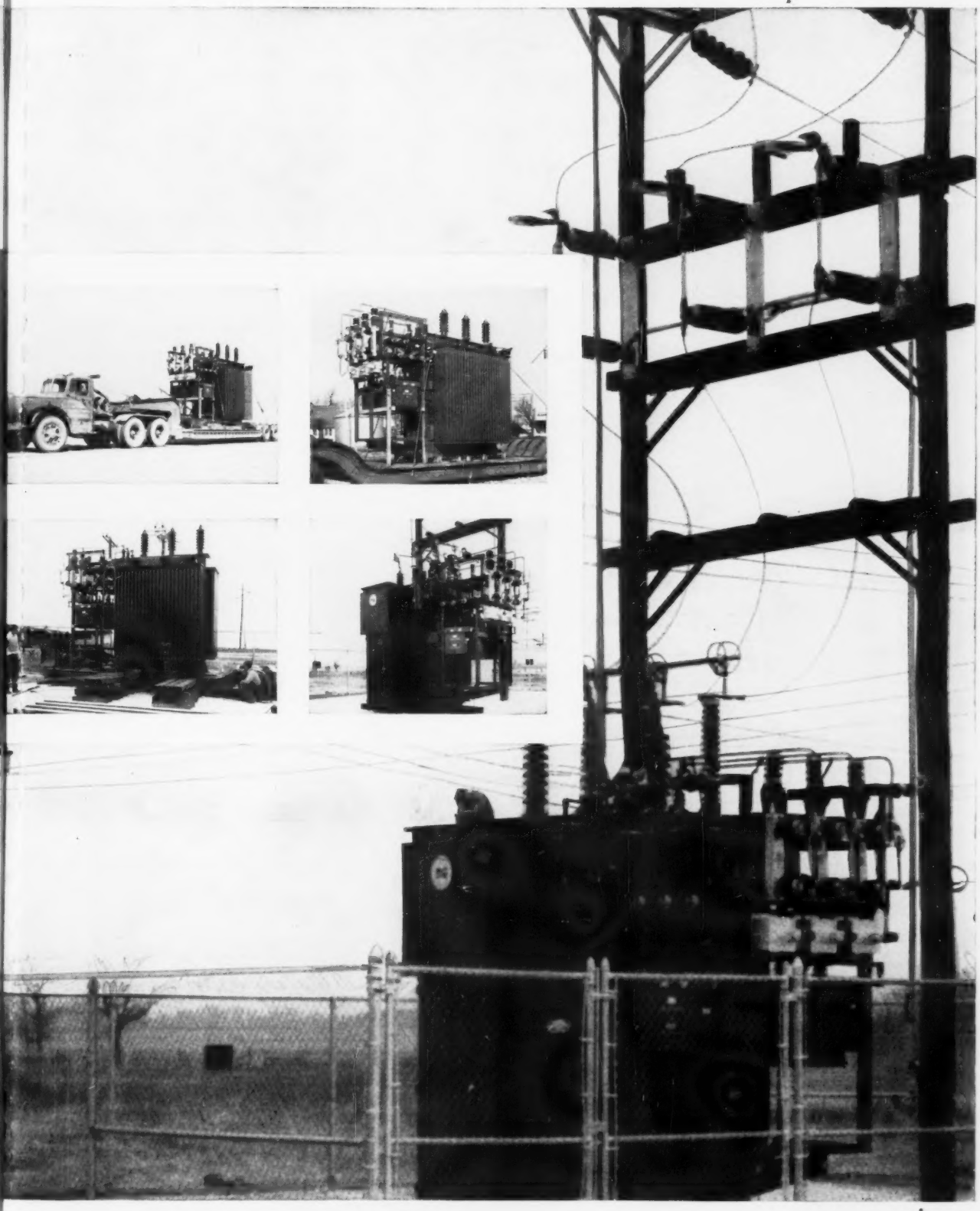
Contact your local Moloney representative for additional information on the Integrated Substation.

MOLONEY ELECTRIC

M O L O N E Y

Manufacturers of

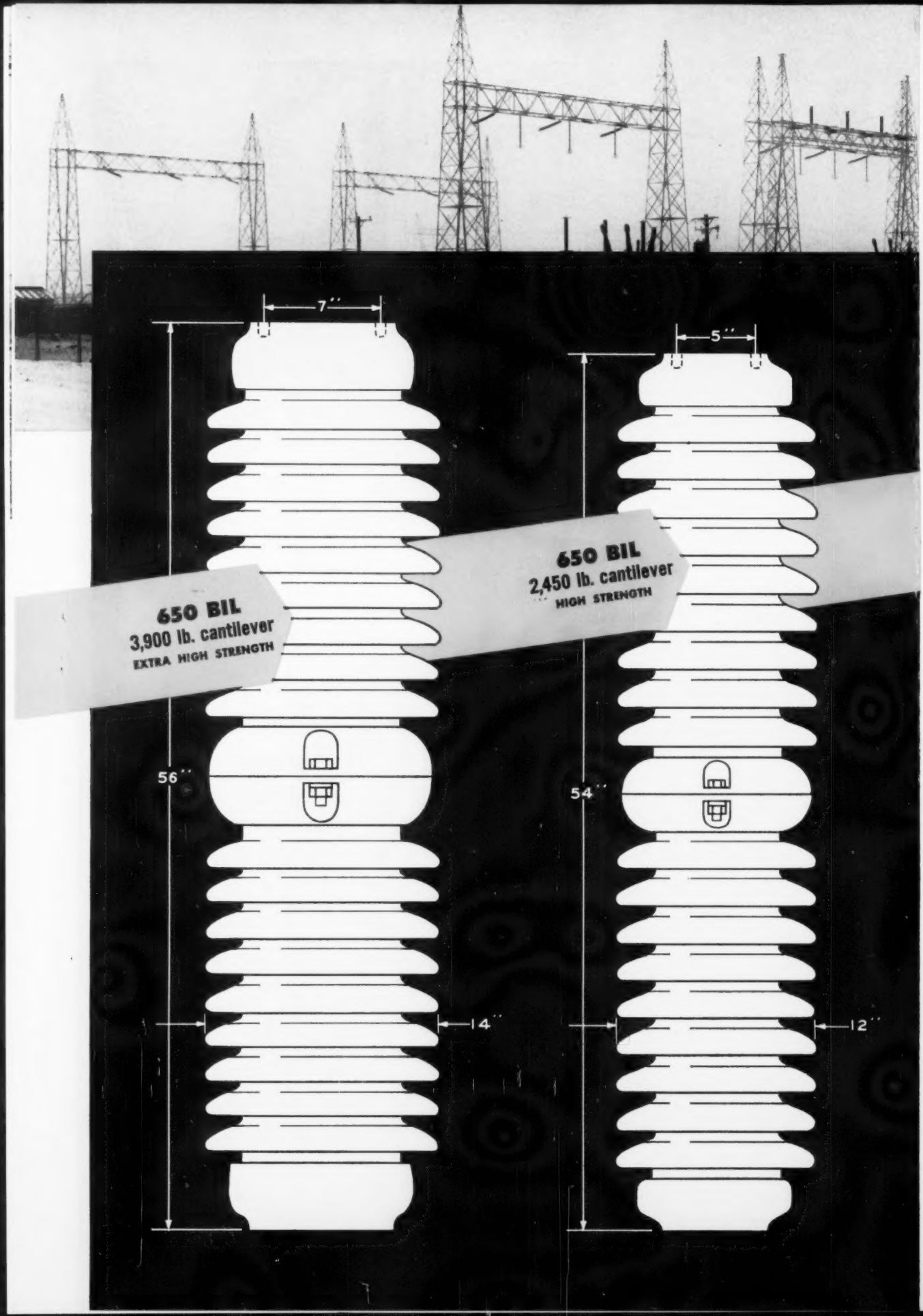
SALES OFFICES IN ALL PRINCIPAL CITIES

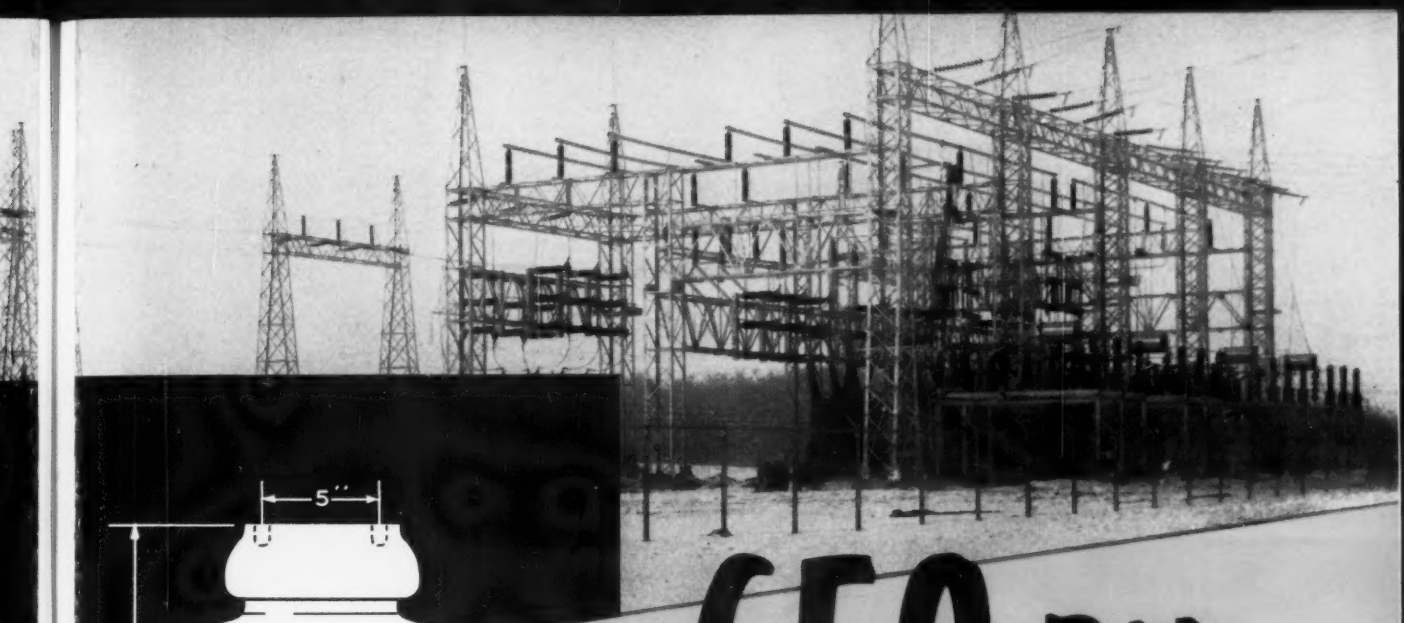


E L E C T R I C C O M P A N Y

Transformers for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA


7"
5"
650 BIL
3,900 lb. cantilever
EXTRA HIGH STRENGTH
650 BIL
2,450 lb. cantilever
HIGH STRENGTH
56"
54"
14"
12"



650 BIL

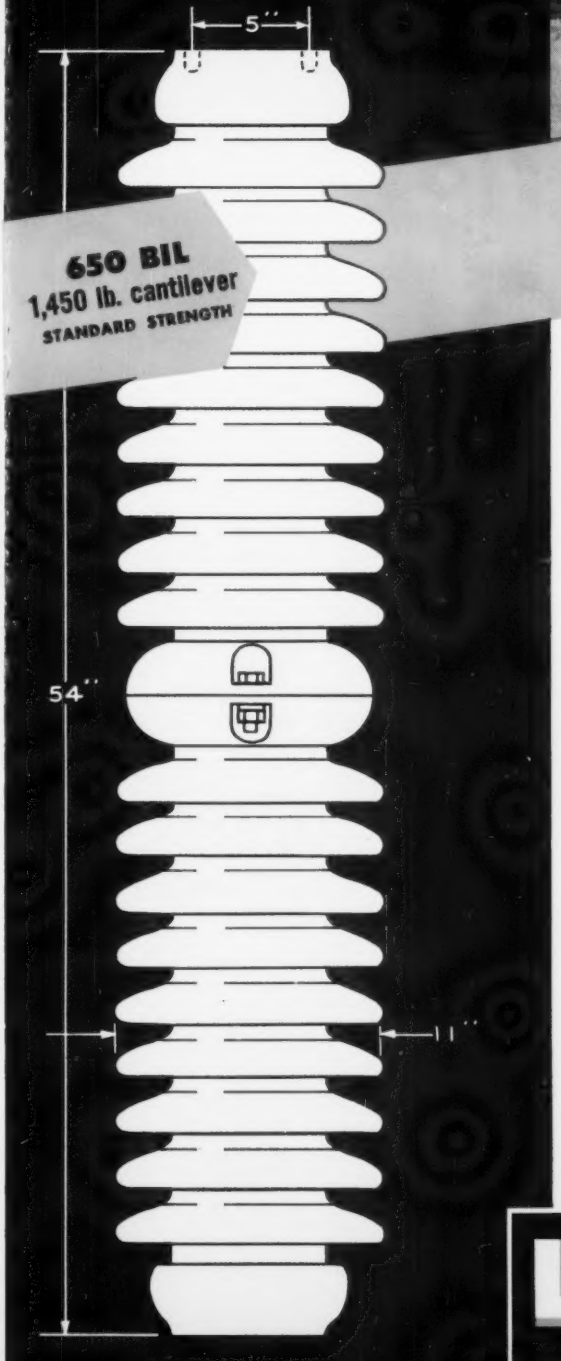
LAPP STATION POSTS

the station insulators specifically designed for 138 kv service

Use of Lapp Station Posts rated at 650 BIL gives designers of 138 kv systems their first chance for most efficient balance of structure cost and electrical characteristics. As compared with use of 161 kv station insulators (until now the only "safe" construction for 138 kv) these new units provide greater strength and rigidity with less weight . . . permit more flexible, more compact station design, with smaller air break switches . . . are suited to horizontal mounting . . . allow wider spacing of bus supports under short circuit forces . . . all at lower costs for insulators *and* structure.

For best performance, highest reliability, lowest cost, design 138 kv stations on Lapp 650 BIL Station Posts.

Lapp Insulator Co., Inc., Le Roy, New York.



Lapp

Federal Pacific Metal-Clad Switchgear is made compact...rugged... and in increasing numbers!

Federal Pacific Metal-Clad Switchgear does the job—it's proven by the growing list of installations across the United States and abroad. Most important, Federal Pacific does it with stronger materials, fewer parts, most modern design, and complete safety to operating personnel.

It's rugged...it's safe...it's easy to maintain...it's accepted!

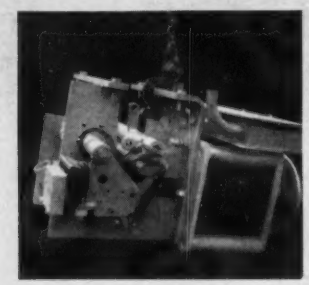
For the full Federal Pacific Metal-Clad Switchgear story call your Federal Pacific engineer or write for Catalog No. 3-440, Federal Pacific Electric Company, Newark, New Jersey.

FEDERAL PACIFIC

METAL-CLAD SWITCHGEAR

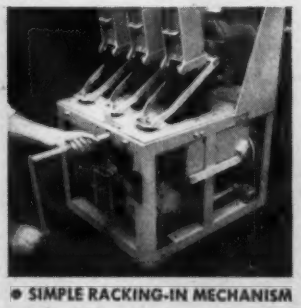
OFFERS UTILITIES

THESE SPECIFIC ADVANTAGES:

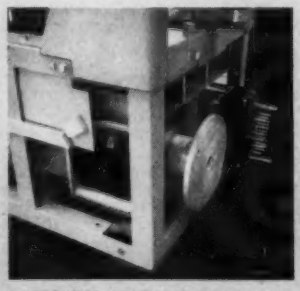


• BREAKER MECHANISM IS COMPLETELY SELF-CONTAINED—Attached to frame by *only four bolts*. No bearings or shafts are in contact with frame. Breaker mechanism can be removed for inspection and maintenance as a unit—simply and quickly.

• PRIMARY DISCONNECTS ASSEMBLY MOUNTS ON BREAKER AS A UNIT—Complete six stud bushing sub-assembly mounted directly on breaker facilitates inspection and service.



• SIMPLE RACKING-IN MECHANISM—Only two moving parts...provides positive safety inter-locking in any position.



• CLOSING SOLENOID MAINTAINS TORQUE TO END OF STROKE—Plunger disc gives solenoid additional pull at the end of the stroke when most needed...to compress closing springs and make positive contact.

FEDERAL PACIFIC

The Best in Electrical Distribution and Control Equipment

The Electrical Week

FUTURE NEWS ▶ **A new probe into power company advertising may be in the offing.** A House Government Operations Committee staff report calls for it. The report says that: (1) A "full scale" investigation by both House and Senate is of "continued importance"; (2) SEC will continue probing the relationship between Electric Bond & Share Co, Ebasco Services, Inc, and previous member utilities of the old holding company; (3) Additional studies should be made into private companies' "distortion of facts"; and (4) Congress should consider amending the Internal Revenue Code to prohibit tax deductions for ad expenses for propaganda and political purposes, if FPC, IRS, or the Supreme Court should permit them in cases now pending.

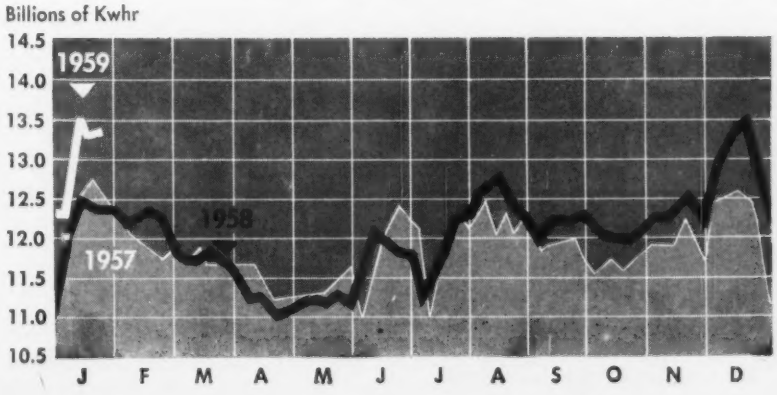
LATE NEWS ▶ **Ontario Hydro and employees' union agree to 1½% wage hike** (3.2¢ hr) retroactive to April '58, with another 2% (4.4¢) from Jan. '59. Another ½% (1.1¢) takes effect Aug. 1, '59.

Washington wire... TVA self-financing bill identical to Senate "Kerr Bill" introduced in House by Rep Jones (D-Ala.) and two others... Sen Gore introduces bill calling for federal construction of A-power reactors with aggregate capacity of 1 million kw...Senate Interior Committee to hold hearings Feb. 13-14 to hear municipals, co-ops and PUD's explain in their power shortages and needs in the Missouri Basin...Reps Johnson (D-Wis.) and Whitten (D-Miss.) introduce identical resolutions calling for probe of alleged power-company "influence" in the office of Comptroller General Joseph Campbell.

First electric auto to come off production line in April, says Stinson Tool & Engineering. Orders placed by 47 utilities.

Management changes... J. R. Morton becomes president at Memphis Light, Gas & Water...R. F. Probst to vp and secretary, Connecticut L&P...L. A. Swanson is new vp at Middle West Service.

POWER OUTPUT—UP 8.0% (Week ending Jan. 24), Kwhr 13,394,000,000



Per Cent Change From Previous Year

	Jan. 10	Jan. 17	Jan. 24
Total U. S.	+ 8.4	+ 7.5	+ 8.0
New Eng.	+12.0	+ 7.7	+ 8.2
Mid. Atlantic ..	+ 7.1	+ 5.3	+ 6.5
Cent. Ind.	+ 9.9	+ 9.5	+10.8
West Cent.	+11.5	+10.0	+12.5
Southeast	+ 4.6	+ 5.0	+ 4.6
South Cent.	+11.4	+10.7	+10.7
Rocky Mount...	+ 9.0	+ 6.6	+ 8.2
Pacific			
NW	+10.6	+ 8.4	+ 7.4
SW	+ 8.0	+ 6.6	+ 6.3

Seasonally Adjusted Index 245.2

Week Ago 243.9 Year Ago 226.8

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Floods that hit East and Midwest did little utility damage** last week. Outages, when they occurred, were short and damage to facilities superficial (p 32) . . . Power is curtailed in Gaspe and Quebec Provinces following failure of Quebec Hydro's 34-mile, 69-kw submarine cable crossing the St. Lawrence River (p 33) . . . It looks as though AEC is going to narrow down its number of reactor concepts (p 34) . . . British charge violation of spirit of "Buy American" Act in Army's award to Baldwin-Lima-Hamilton over English Electric for two water wheels (p 35) . . . Con Ed to lay 69-kv feeders in Queensborough Bridge abandoned trolley lanes—**Cover and page 37.**

ENGINEERING ▶ **Local back-up relaying protects system** at Northern States Power Co. Single-step impedance relays, providing back-up tripping of bus sections in 115-kv substation, lessens chance of excessive generation losses (p 38) . . . Increased automation steps up meter testing at Consumers Power Co to a rate of one meter every 1.4 minutes, using a one-man testing procedure (p 44) . . . Sulphur hexafluoride (SF_6) may replace oil or air as the arc-quenching medium in circuit breakers and switches of the future. Some of the things you ought to know about SF_6 are covered by Westinghouse engineer A. P. Strom on **pages 40-41.**

Politics and Public Power

Several **TVA practices came under fire** of Comptroller General Joseph Campbell. In his annual audit report to Congress, Campbell made the following recommendations:

• TVA should not be permitted to build new generating facilities from either its own revenues or from non-federal funds without specific Congressional approval. Best policy, he thinks, would be to require TVA to build new facilities only with appropriated funds.

• TVA should be required to pay interest to the Treasury on funds invested in power operations. He said, "We (General Accounting Office) believe that the matters of interest on and repayment of the (TVA) power investment should be considered concurrently because they are interdependent. Therefore, we are continuing our recommendation that the Authority be directed to pay interest on the investment of federal funds allocated to power, including construction in progress and investigations for future projects, at a rate adequate to reimburse the U. S. Treasury for the cost of providing the funds, and if necessary for the sound conduct of the power program, that the statutory repayment requirement be modified."

• TVA should make a study to determine whether its current rate of return on power sales is in line with its needs. Campbell noted that TVA now operates on 4%, but no study has ever been made to determine whether this is high or low. He noted that TVA's 1958 return dropped to 3.59% from 4% in the previous fiscal year. Most of this was due to a "significant" drop in sales to AEC.

• Procedures for spot bidding should be revised to drop the use of a preference clause in the invitations. If such clauses are to be retained, Campbell thinks a monetary value should be put on the preference, or a clause should be inserted that the preference right

MANAGEMENT ▶ **Order boilers and turbines now or risk late delivery.** That's the stark prospect offered by several manufacturers, unless electric utilities place their orders early in '59 for equipment needed in 1962 and 1963. Read why manufacturers say utilities must alter their cyclical ordering pattern, beginning on **page 63.**

MANUFACTURERS ▶ **A five-station microwave system,** built and installed by Collins Radio Co for Tampa Electric, ties in all the utility's operations centers, business offices and mobile radio fleet **(p 51)** . . . GE realigns prices on mobile transformers and substations, oil-immersed current-limiting reactors, and furnace transformers **(p 51).**

NEW EQUIPMENT ▶ **Data-logging system is designed for all applications** in which centralized data transmitting and logging are required . . . Tapeless connector for underground distribution systems join as many as eight cables where water-tightness must be insured . . . Current transformer has 400/800-amp dual range to provide extended capacity for future growth **(p 54).**

PEOPLE ▶ **Southern Services names E. D. Early and E. S. Harrison vp's.** Details of these and other personnel changes on **page 73.**

would be considered only where bids were otherwise identical.

New Federal Power Commission dam licensing standards are proposed in a bill introduced by Sen Warren G. Magnuson (D-Wash.) and five other Pacific Northwest senators. The bill (S-584) defines the term "comprehensive development," which is used by FPC as a basis for issuing 50-yr licenses for hydro projects. Magnuson said the new legislation was necessary because "the present law gives the FPC too much latitude and does not provide the commission with an acceptable definition of what a comprehensive development plan is, nor the type of project that fits into such a plan." Aim of the bill would be to require FPC to consider the "maximum amount of net public benefits" for each licensed project—including power generation, flood control, irrigation, conservation, etc. Each project would be considered in relation to other projects, built or planned, in the same river basin. Bill has been referred to Senate Commerce Committee.

California Gov Brown came out for public power as an integral part of water development last week when he presented the state legislature with a sweeping $658 million water development program. Brown recommended state construction of power facilities at dams built on the Feather River project, as well as restating his opposition to "partnership" construction at the Trinity project. Brown says power will be used to move water through aqueducts from northern part of the state to arid southern parts. Proposed financing: Commitment of the state's Investment Fund of $158 million, built up mostly from oil royalties, plus a $500 million bond issue in 1960.

Molding a clear, persuasive corporate image requires that management select products or services to be identified with the company; decide on what basis the company is to be distinguished from others; and understand and use public relations and advertising in shaping the image.
Sharper Focus for the Corporate Image, Pierre Martineau, Harvard Business Review, November-December, 1958.

Growing shortages and costs of process-cooling water are forcing processors to turn to air-cooled heat exchangers for partial solution of their problems. **Petroleum Week, December 19, 1958.**

Cost savings and operating advantages follow use of double-bus switchgear in 4.8-kv distribution substations on the Detroit Edison system. Single-bus substations are used only in areas of very restricted load growth. **J. G. Spath and J. B. Oliver, Electrical Engineering, December, 1958.**

TECHNICAL NOTES

Accurate degree-day weather predictions offer economy by narrowing the period during which full system capacity must be held in readiness for air-conditioning peak loads. Longer-range predictions might defer system additions for a year or two.

Conductivity of a rapidly-changing plasma now can be determined over a much greater range than was possible previously.

Sodium-water reactions can be endured in a nuclear reactor without significant effect as long as the reaction occurs in an inert atmosphere and adequate venting and expansion volumes are provided.

FROM EDITORS IN THE FIELD

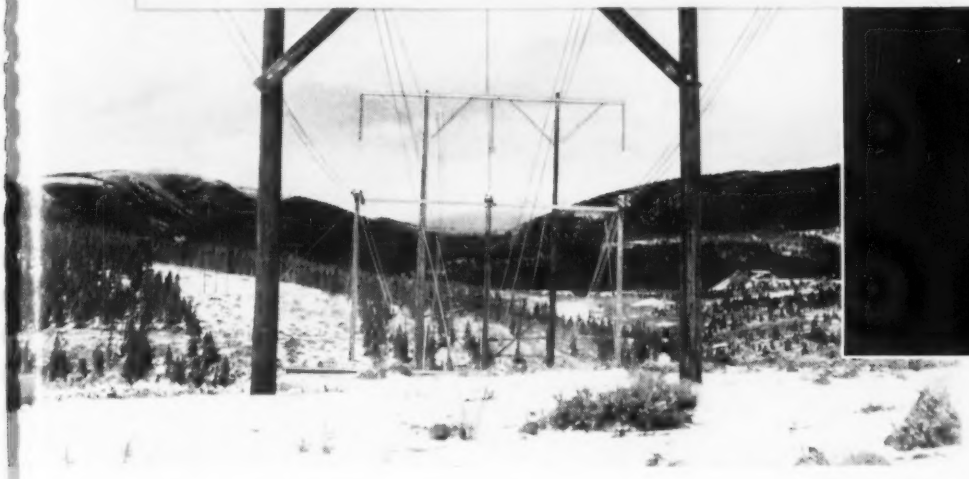
Inventory is reviewed about every 60 days at Duke Power Co. Slow-moving items then are used rather than similar new products being ordered.

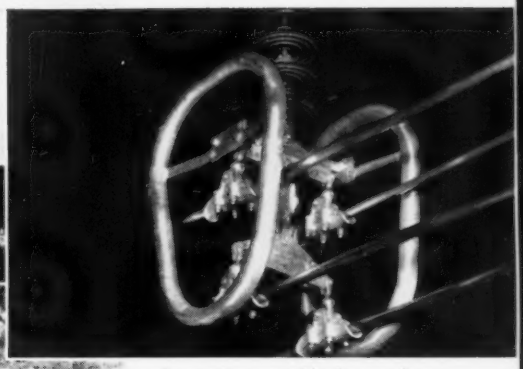
Radio isotopes and green dye combined to show how well an artificial lake might provide cooling water for the Maitland Power Station, New South Wales, Australia.

Bundling of 115-kv line usually costs less than reconductoring, reduces reactance by 25%, and increases capacitive charging current by 40%. This is the experience of a large southeastern company in the bundling of 33 miles of line.

Ready for tomorrow's EHV!

O-B insulator and hardware designs have been proved suitable for higher voltages





Suspension assembly for quadruple 1.40-inch bundle conductor test line, shown on test in O-B laboratory above, shown installed on test line at left.

400-kv? 550? 600? One, two, or four conductors? You make the choice as to what will serve your needs best when you plan an EHV line. You need not be limited in your thinking by hardware and insulator designs. Proved designs are already available. Some have served successfully for as many as seven years on 345-kv lines. Other designs to fit your specific requirements can readily be developed.

For higher voltages and multiple conductor bundles, optimum arrangements of insulators, clamps and shielding devices have already been proved in laboratory testing. It's significant that the clamps and insulators are of standard O-B design. The inexpensive shielding devices are modifications of designs now in service on 345-kv lines.

So as you make your EHV plans, keep this in mind. Laboratory facilities, design experience, manufacturing technique and the actual insulators and hardware designs themselves are available to meet the requirements of extra-high voltage transmission lines.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass ®

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

Choose

Extended foil cooling minimizes temperature-rise, increases life expectancy of O-B capacitors

cool VAREX®

for long life

Heat in a capacitor is an inevitable result of its being submitted to electrical stress.

However, the amount of temperature rise can be held to a minimum by design factors, use of quality materials and elimination of contamination.

The design principle responsible for efficient cooling in Varex elements is the extension of aluminum foil at each end of the element. There is an unobstructed path for heat flow from the center to the end of the element. A minimum thermal barrier between element and case also promotes efficient heat flow to the sides of the container.

No one can tell you for sure how long a capacitor will last when installed on your lines. But one of the most important influences on capacitor life is its operating temperature. For every eight to ten degrees centigrade increase in operating temperature, capacitor life is reduced by an estimated 50 per cent. This is particularly important when the ambient or hot spot temperature exceeds the operating limits recommended in Capacitor Standard ASA C55.1.

Foil-cooling, as developed in Varex, is an effective way to hold temperature-rise to a minimum. That's why you can expect longer capacitor life when you specify Varex for your system.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

Just like a third hand!

Keeper-piece on new O-B Universal Clamp stays open while jumper loop is formed

The 88500 Universal Clamp stays open automatically while the lineman forms and bends the conductor. It remains open until the conductor is in position and the rounded nuts are tightened on the U-bolt. It's just like having a third hand.

Made of corrosion-resistant malleable iron, the 88500 accepts conductors between .20 and .50 inches in diameter. Holding strength is more than adequate for distribution deadends, helped by the snubbing action inherent in the clamping face.

Among other points that save installation time: the high wall along the clamping section which effectively retains the conductor during installation, all operations can be done from one side, and there are no loose parts to worry about.

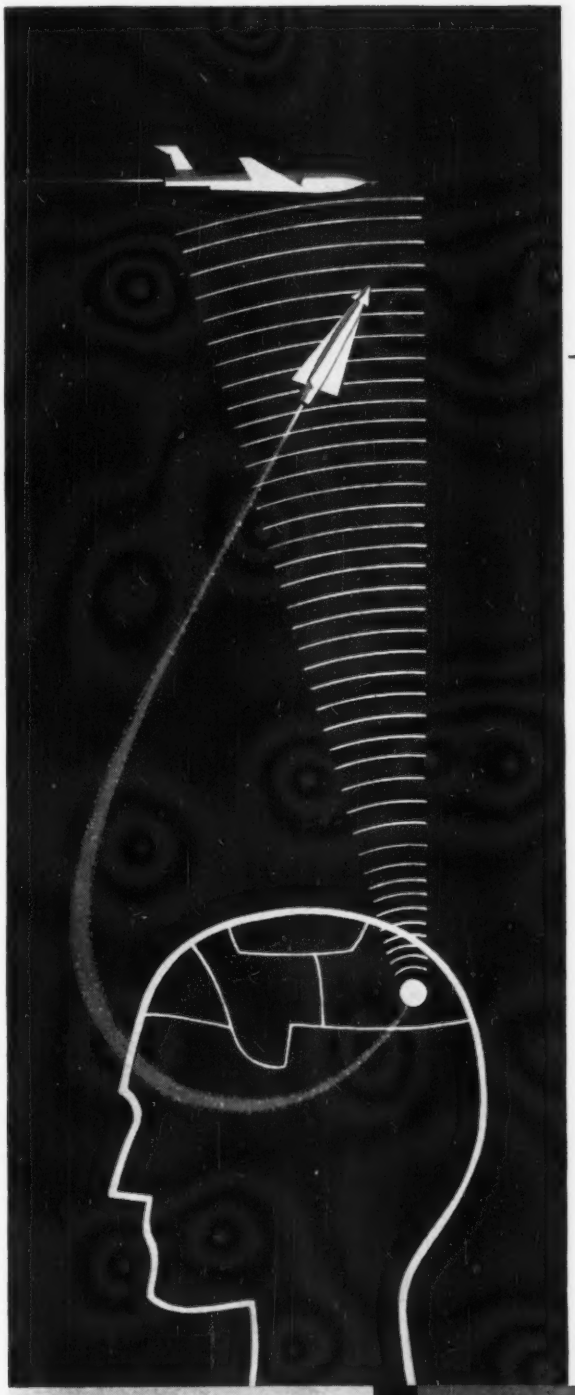
If efficient deadending of distribution lines is one of your objectives, you can get important help by using the new O-B 88500 clamp.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass (B) HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4955-H



From Bell Telephone Laboratories...

Brainpower
for the brawny
Nike-Hercules

The Army's newest surface-to-air guided missile—the lethal Nike-Hercules—is now operational. Because it is, no unfriendly plane will be able to fly sufficiently high, fast or evasively to escape a fatal rendezvous with it.

For Hercules has a "brain"—an intellect that makes it a prodigy among today's electronic robots. Bell Telephone Laboratories developed it. Western Electric (prime contractor for the entire missile system) is producing it. Douglas Aircraft Company is giving it its body.

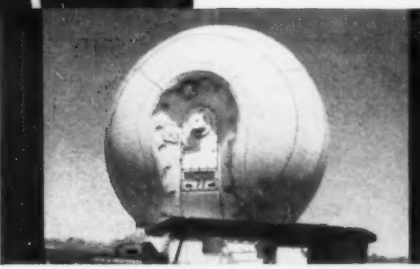
This "brain" is a fully integrated guidance system, almost entirely land-based. Only the vital signal-receiving apparatus is expendable within the missile itself. Other highly practical features: it defies "jamming," is completely mobile, is designed in separate "building block" units which are replaceable in seconds—and is deadly accurate.

Bell Labs scientists and engineers designed the world's largest and most intricate telephone communications network for the Bell System. They developed about half of the Armed Forces' radar equipment during World War II. And they pioneered the nation's *first* successful air defense guided missile system—Nike-Ajax.

They were eminently qualified to give Hercules the brainpower it needed.

BELL TELEPHONE LABORATORIES
World center of communications research and development

Vigilant acquisition radar for Nike-Hercules first detects approach of distant aircraft, pinpoints its location and instantly signals to battery control.



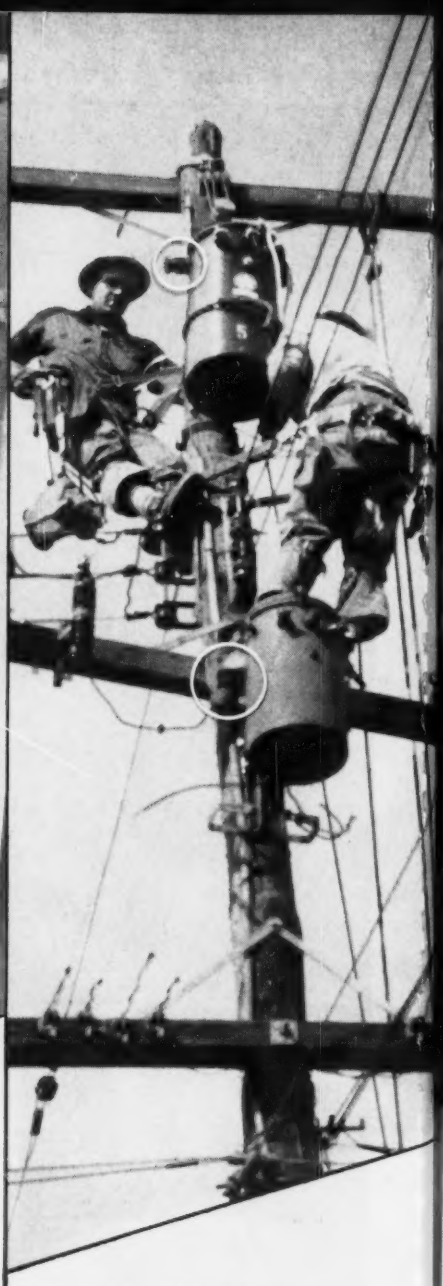
Two tracking-radar antennas, housed in radomes, take over. One feeds target azimuth, elevation, range data to computers; other tracks Hercules.

Two sets of radar data are electronically computed and plotted. Hercules is "steered" by radio signals, then detonated at precise point of interception.

Many improvements in distribution transformers are initiated by Pennsylvania **Pole Star** transformers

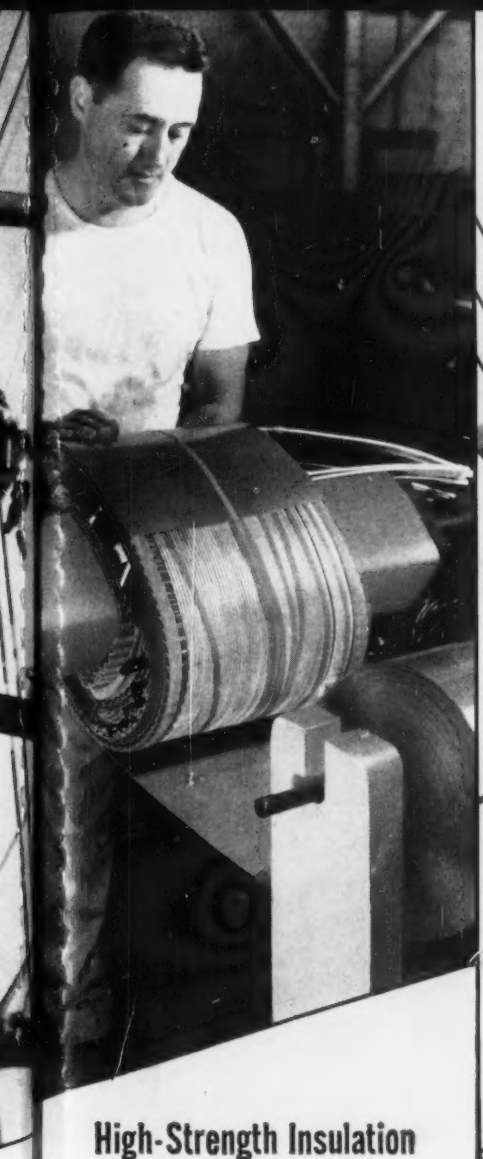
Test Programs and Committee Work Further Industry-wide Progress

Since the inception of an AIEE program in 1956, Pennsylvania Transformer Division has been actively participating in a series of insulation life tests. By contributing time, facilities and personnel, and by taking part in other committee activities and projects of AIEE, EEI and NEMA, Pennsylvania is helping to provide the entire electrical industry with valuable information and guidance.



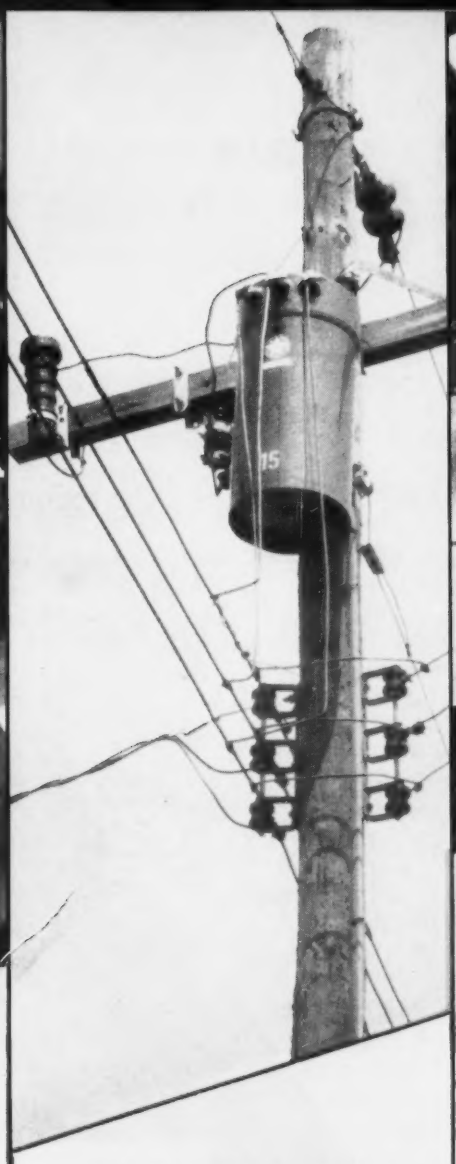
Pole Star's Stud-type Sidewall Bushings Eliminated Pockets

When the Pole Star was introduced more than eleven years ago, Pennsylvania pioneered the use of streamlined, leak-proof, stud-type bushings. Such innovations —when improved materials and techniques make them feasible— are typical of Pole Star leadership.



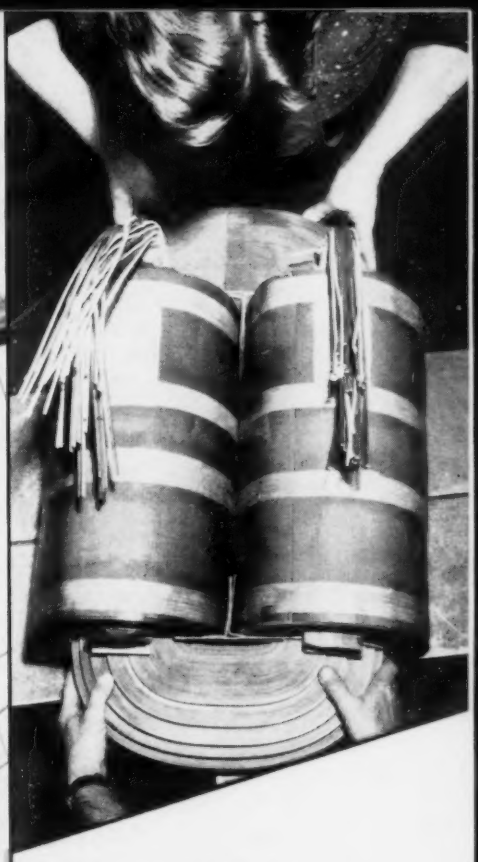
High-Strength Insulation System Gives Pole Stars Greater Life Expectancy

Introduced almost without fanfare more than four years ago, the Pole Star insulation system has been proved equal to or better than all other systems from the all-important standpoints of insulation strength and life expectancy. The system consists largely of pre-treated insulating materials that include corrugated spacers and specially processed kraft paper that possesses exceptionally high electrical and mechanical strength at higher-than-normal operating temperatures.



First Completely Sealed Distribution Transformers Now in Actual Service

The "Perfect Seal" Pole Star—a completely sealed distribution transformer—appears to be the transformer-of-the-future as a result of present trends toward the elimination of taps in many voltage classes. Working with various electrical utilities throughout the United States, Pennsylvania has distributed a number of completely sealed distribution transformers for "in service" observation and testing.



Lap-on-Top Core One of Four Basic Distribution Cores

The patented lap-on-top Pole Star core is one of but four basic distribution cores being used today. Designed to take full advantage of the inherent characteristics of cold-rolled, grain-oriented silicon steel, it is notable for its low exciting current, low core loss and consistently high quality.

McGRAW EDISON

Pennsylvania Transformer Division

McGraw-Edison Company
CANONSBURG, PENNA.
Greater Pittsburgh District

Another example of Allis-Chalmers

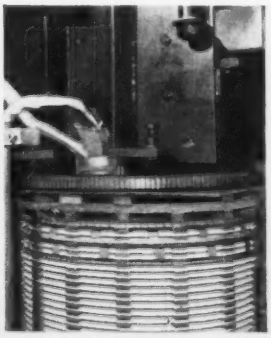
GENERAL INFORMATION		CLASS OF COOLING
KVA	36000.	TYPE OF L.T.C.
NUMBER OF PHASES	3.	L.T.C. TE V
WINDING	HIGH-VOLTAGE	GE
LINE VOLTAGE	230000.000000	00
TYPE OF CONNECTION	G. WYE	
RATIO OF MAX. TO NORMAL	1.050000	
RATIO OF MIN. TO NORMAL	0.95000	
LINE TEST VOLTAGE	395.000	
NEUTRAL TEST VOLTAGE	34.00	
VOLTS PER TURN	143.	
NO. OF TURNS PER COIL	80	
NUMBER OF COILS		
NORMAL PHASE CURRENT		
MAXIMUM PHASE CURRENT		
CM PER AMPERE		
TOTAL CIRCULAR MILS		
SIZE OF CONDUCTOR		
INSULATION ON STRANDS		
COIL HEIGHT		
MEAN TURN LENGTH		
I SQUARE R LOSS		
EDDY CURRENT LOSS		
WATTS PER SQUARE		
GRADIENT		
	HEIGHT	
	EIGHT	
	NIDTH	
	ENGTH	

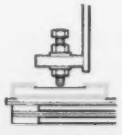
Get All the Facts

Call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Balanced Electrically

Corona-free design puts solid insulation at the point of critical dielectric stress. Shielding protects against repeated switching surges. Line ends of windings are protected from steep wave impulse jolts. Coordinated design throughout windings provides proper margin of insulation strength for all types of overvoltages.





CLAMPING RING SHIELDING

END TURN SHIELDING

leadership in transformers

Plan to stay ahead... MODERNIZE!

Approaching Perfection in Power Transformers Through Electronics

At Allis-Chalmers, the pursuit of perfection utilizes the mathematical wizardry of the computer. Given selected values for variables, tempered with rejection criteria, the computer produces preliminary designs in a matter of minutes. As a result, countless engineering hours are freed for furthering perfection . . . for the creative development of new ideas for transformer improvement.

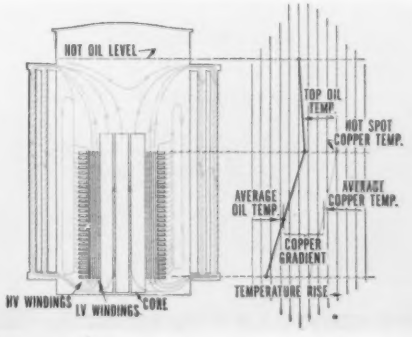
Balanced Design

The most important contribution made by the computer is "Balanced Design"—a design in which each feature complements the others to provide unmatched performance and long life.

Balanced Thermally

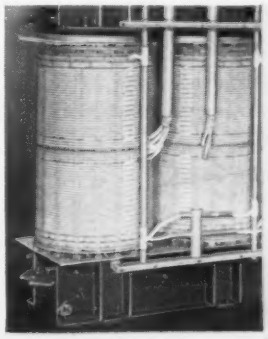
Low gradients add years of service. Coil ducts in windings allow oil to flow through and around all layers for uniform cooling. On larger units, core spacers form ducts that permit oil to flow through the core.

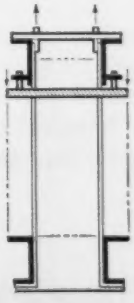
Transposition in windings keeps eddy-current losses low and distribution of current in conductors balanced.



Balanced Mechanically

High and low voltage coils are held rigidly between steel plates and supported on core end frames by jack bolts. After thorough dry-out, coil structure is compressed to specified values by jack bolts. Lead assembly is supported against short-circuit stresses while maintaining proper insulation distance.





ALLIS-CHALMERS

A-5874

MR-20 MOTOROLA MICROWAVE

...means more multi-channel, point-to-point efficiency for each communications dollar

Here is microwave at its finest—Motorola-engineered to give you the greatest dollar return in communications flexibility, long-life service and all-weather dependability. Literally millions of orders and instructions by voice, printed message and control signals are carried by Motorola Microwave every day. Point-to-point operation spans city streets, rivers, plains and mountains to speed this information on its way at the lowest per-mile operating and maintenance costs.

Simple, "building-block" components—Motorola MR-20 and associated multiplex equipment—can be fitted to your communication need to provide for any combination of voice, control and data transmission, including 2-way radio operation. Let Motorola Microwave bring the full efficiency and the money-saving opportunities of just-right communications to your operations.

Send for illustrated Brochure 1188.

MR-20 Microwave RF equipment . . . even more simple and reliable for maximum dollar value

- **Automatic Switchover-Switchback** . . . provision available for bi-lateral switching where desired.
- **"Hot" Standby** . . . enables switchover to pre-heated unit in less than one second.
- **Simplified Waveguide** . . . allows additional RF channels to be multiplexed to common antenna.
- **Frequency Diversity** . . . provides maximum circuit continuity in 5925-6425 MC band.
- **Plus outstanding Motorola developments for 6000 MC operation** . . . explained in detail in Brochure 1188.

MOTOROLA MICROWAVE

Motorola Communications & Electronics, Inc., A Subsidiary of Motorola Inc., 4501 Augusta Blvd., Chicago 51, Illinois

Slam it closed "blind"...

this cutout never misses!

The lineman doesn't have to steer the fuse tube into the contact of S&C's XS Cutout

If the lineman closes into a *fault* and misses—where is the lineman?

If he closes into a *load* and misses—what can the lineman do?

Even an experienced lineman shouldn't be expected to steer a cutout closed; for safety's sake, he must look away.

For positive steering when closing, the fuse tube of S&C's XS Cutout is controlled in four ways:

(1) The tube trunnion is thrust firmly forward into pockets in the hinge by the contact springs.

(2) The tube trunnion is simultaneously stabilized by the hinge's inner surfaces acting on the vertical faces of the trunnion casting.

(3) At the same time, guide edges of the hinge steady the corresponding edges of the lifting eye in the tube trunnion casting.

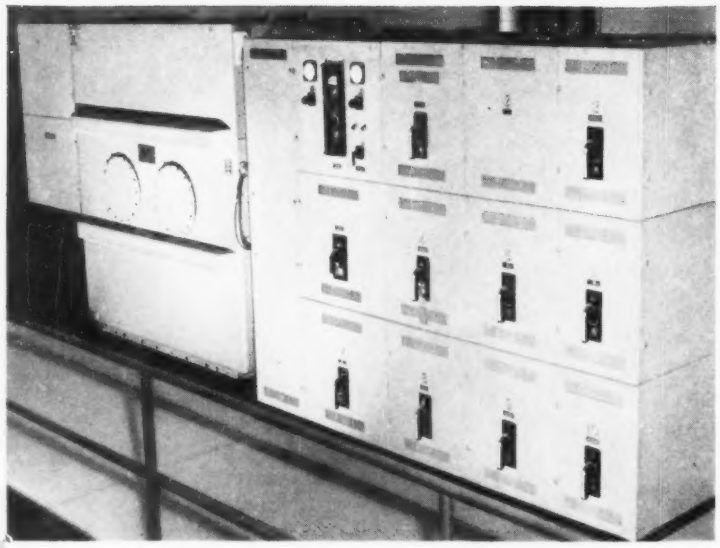
(4) LOADBUSTER® attachment hooks act as guides to steer the fuse tube as it "wipes in" and seats positively.

These four elements provide certain closing action, even when slammed home blind. And on dark and windy nights, closing is a sure thing, without hang-ups or damage.

For full information about the XS Cutout and its use with LOADBUSTER for load switching, write for Bulletin 511 to S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road. Toronto 14, Ont.

S&C DISTRIBUTION CUTOUTS

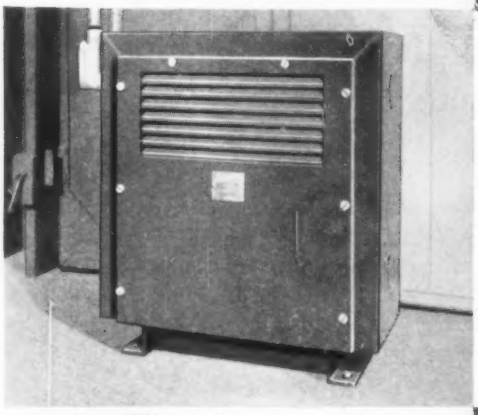
Disconnects • Cutouts • LOADBUSTER® • Interrupters
Metalclad Switchgear • Fuse Links • Power Fuses



Wagner

SEALED DRY-TYPE TRANSFORMERS

These modern unit substation transformers can be safely installed in any load-center—any place—because they are hermetically sealed in welded steel cases to provide positive protection from contamination, fire and explosion hazards. The only maintenance needed is periodic checking of gas pressure (inert nitrogen), case and bushings.



Here's Reliable Power

for your plant electrical system

WAGNER LOAD-CENTER TRANSFORMERS

Wagner

INDOOR DRY-TYPE TRANSFORMERS

These new quiet-type transformers are compact, light in weight, provide a flexible, modern power system to change higher voltage distribution service to lower voltage lighting and power circuits. They meet all safety requirements for indoor installation.

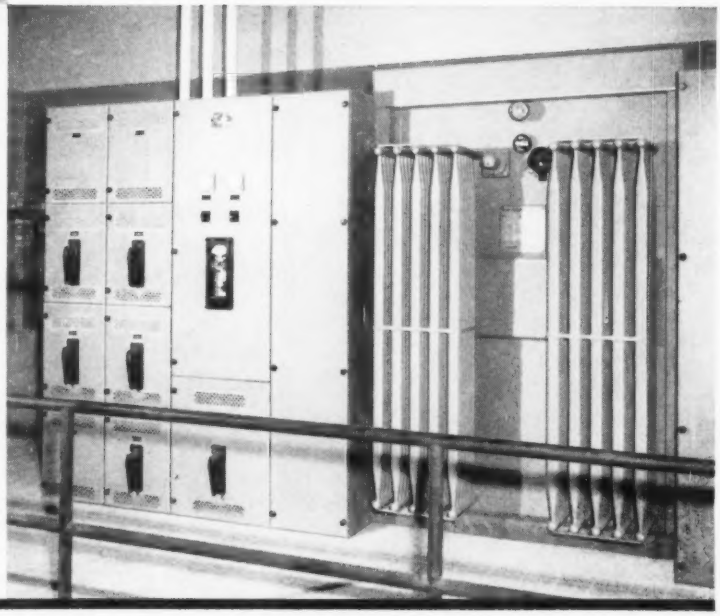
Wagner

NOFLAMOL TRANSFORMERS

Non-inflammable liquid filled. For indoor or outdoor installation. Close-coupled design fits flush against switchgear enclosures, to eliminate and save space. Throat-connected designs are also available.

Bulletins TU-205 and TU-214 give full information on Wagner Load-Center Transformers. Write today.

WT59-2

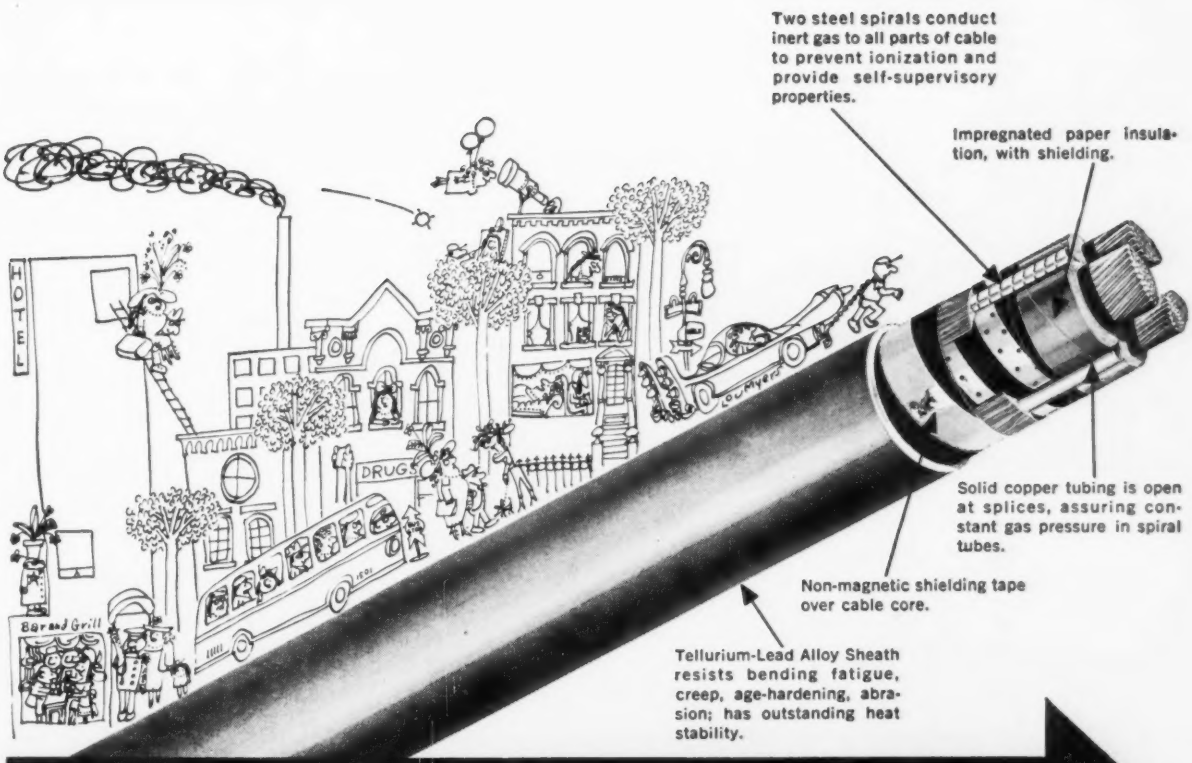


BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 Plymouth Ave., St. Louis 14, Missouri.

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL . . . AUTOMOTIVE*


Two steel spirals conduct inert gas to all parts of cable to prevent ionization and provide self-supervisory properties.
Impregnated paper insulation, with shielding.
Solid copper tubing is open at splices, assuring constant gas pressure in spiral tubes.
Non-magnetic shielding tape over cable core.
Tellurium-Lead Alloy Sheath resists bending fatigue, creep, age-hardening, abrasion; has outstanding heat stability.
HOTEL
DRUGS
Bar and Grill

KEEPS UPHILL POWER "ON THE LEVEL"!

ROEBLING
GAS-FILLED CABLE

What happens when solid-type cable is used on steep grades? If you've used it, you know! The oil impregnant simply obeys the law of gravity and drains to the bottom of the grade. At the low point, hoop stress (caused by oil pressure build-up) makes the lead sheath stretch. Eventually a rupture occurs. And in the areas drained of oil, ionization takes place.

What's the answer to this constant (and inevitable) problem? *Roebling Low-Pressure Gas-Filled Cable*—for voltages up to 46 kv! Dry nitrogen gas, inside this cable at approximately 12 psi pressure, provides consistent dielectric properties throughout the length of the cable. No matter how steep the grade, internal pressure is uniform everywhere.

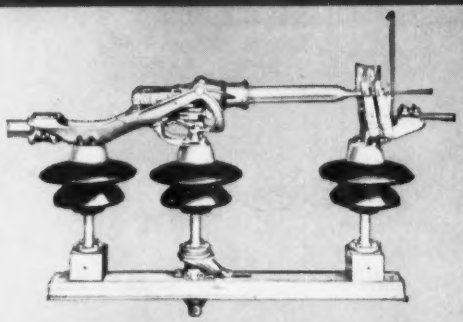
Another feature of this cable is that it is self-supervisory—an alarm system lets you know if there's trouble along the line.

Roebling Low-Pressure Gas-Filled Cable is as easy to splice as solid-type paper power cable. It offers the least expensive long-term answer to the problem of transmitting power uphill! Get the whole story from your Roebling Field Representative soon. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

L-M Offers



VERTICAL BREAK and side break switching equipment (34.5 kv) has silver-to-silver contacts, few current-interchange points, and excellent lever advantage for breaking ice or corrosion. Bearings lubricated with silicone grease sealed in for life with silicone cord rings which are not affected by weathering or contamination. A complete line of L-M switches for vertical and horizontal mounting is available. Oil-filled load interrupter attachment for 34.5 kv vertical break switch also available.

THREE-PHASE 20/34.5 KV TRANSFORMER POLE. Three 10 kva Round-Wound transformers with 150 kv BIL are shown with L-M Type SS 27 kv arresters and 27 kv Type HDO cutouts. All this L-M equipment was specifically designed for this service.

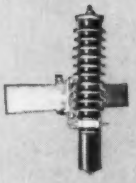
LINE MATERIAL

McGRAW-EDISON COMPANY

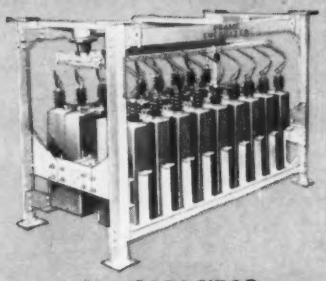
Distribution

DISTRIBUTION TRANSFORMERS • PAD-MOUNTED AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS
LIGHTNING ARRESTORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS

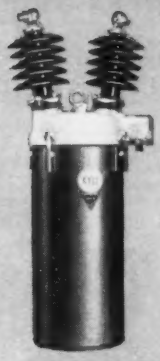
the Most Complete Line of Equipment for 20/34.5 kv Distribution



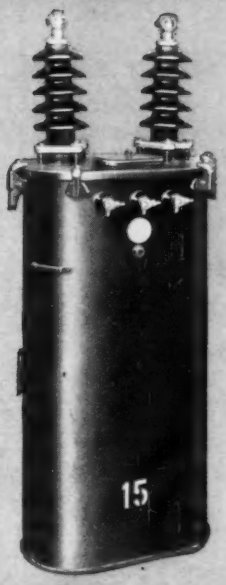
L-M'S 27 KV TYPE SS distribution valve type arrester provides low-cost protection for 150 kv BIL apparatus.



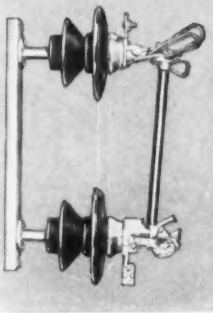
CAPACITOR EQUIPMENTS, blocks and banks to any size.

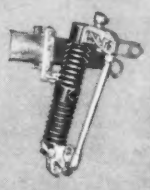


KYLE TYPE E RECLOSER, 23 kv, 150 kv BIL, in standard ratings, for single-phase extensions of the 20/34.5 system where the potential across the recloser will at no time exceed the maximum design voltage of 25.8 kv.



20 KV ROUND-WOUND® TRANSFORMER, specifically designed for this service, with 150 kv BIL, high overload capacity, low exciting current, and low losses.





TYPE HXO POWER FUSE (left) and Type HDO fuse cutout. The 27 kv, 100 ampere HDO has a rated interrupting capacity of 4000 amperes. The 38 kv, 200 ampere HXO has a rated interrupting capacity of 5000 amperes.

How 34.5 kv Distribution Cuts Costs... Here's Data on Methods, Materials

- Idaho Power Company pioneers 20/34.5 kv distribution, with ten years' experience.
- L-M pioneers, with research and development on apparatus, construction materials, and application for this economical distribution voltage.

by J. R. McDONALD, Field Engineer
Line Material Industries

Complete elimination of subtransmission, with fewer substations, higher feeder loading, and reduction of regulating equipment, resulting in lower cost per kva of installed capacity, appear to be among the major advantages afforded by 20/34.5 kv distribution, according to Idaho Power Company.

This progressive company now operates 275 pole line miles at this higher distribution voltage, and is expanding the system to serve additional farm customers. Idaho Power has found economical methods for conversion, and its experience is being generously offered to the industry. At the same time others, such as H. L. Hess of the Public Service Company of Indiana, Inc., have published the results of their studies.

L-M Provides Information, Apparatus

L-M has collected some of this data, and is offering a compilation, along with information on the apparatus and equipment L-M engineers have developed in working with Idaho Power Company and others.

Mail This Coupon For More Information

Ask your L-M Field Engineer for copies of papers L-M makes available on 20/34.5 kv distribution, or mail the coupon—and we will send them promptly—no obligation.

LINE MATERIAL Industries, Milwaukee 1, Wisconsin EW-229

Please send, free, copies of the following papers:

- ☐ 20/34.5 kv—An Economic Solution, by Don E. Haasch, Special Studies Engineer, Idaho Power Company
- ☐ 34.5 kv—A Possible Future Necessity, by H. L. Hess, Distribution Engineer, Public Service Company of Indiana, Inc.
- ☐ 20/34.5 kv Multi-grounded Wye Distribution System, by George W. Cooper, Line Material Industries
- ☐ Relative Merits of 20/34.5 kv Distribution by D. L. Andrews, Distribution Studies Engineer, Idaho Power Company
- ☐ The Long-Bus Substation, by D. L. Andrews, Distribution Studies Engineer, Idaho Power Company
- ☐ SEND ALL FIVE PAPERS PLEASE, IN FOLDER IMPRINTED WITH MY NAME

Name_____ Title_____

Company_____

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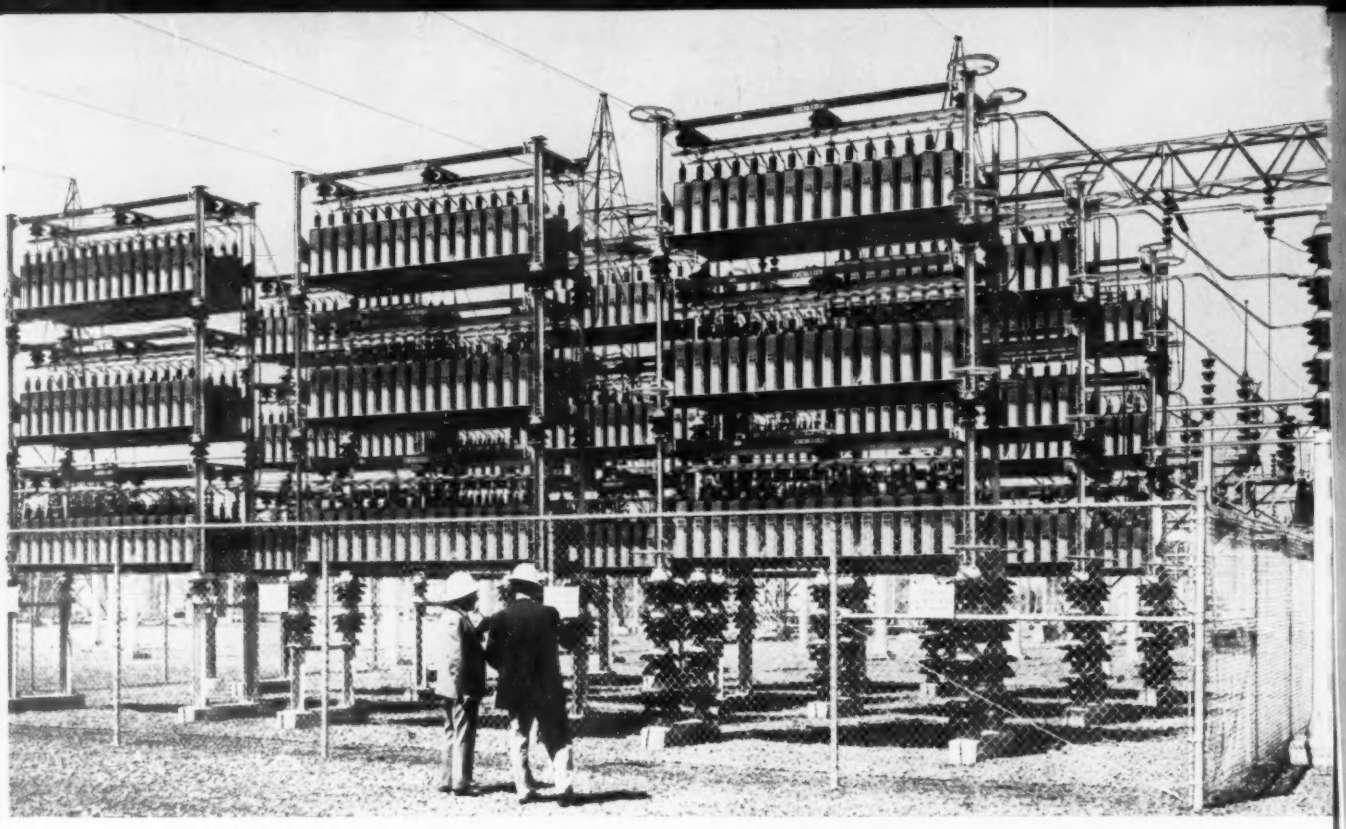
City_____ State_____

Industries Equipment

McGRAW EDISON

370

LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS
PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



L-M ENGINEERS design many large capacitor banks, such as this 40,500 kvar, 230 kv switched bank, said to be the highest voltage shunt capacitor bank in the country. It is made up of L-M factory-assembled and wired blocks of 50 kvar Elemex capacitors, such as the one shown below.

L-M Designs Capacitor Installations From 240 Volts To This 230 kv Bank

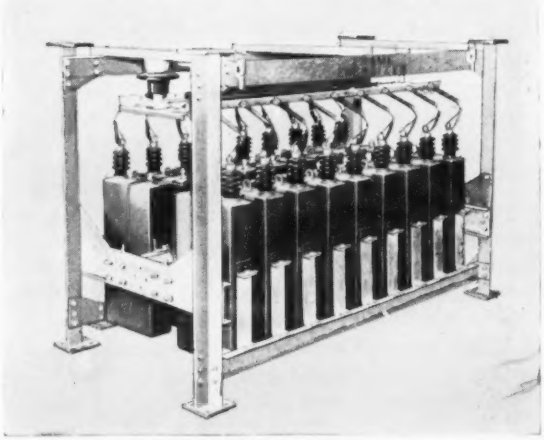
The bank shown above (location on request) consists of twenty-seven 1500-kvar split-bus capacitor blocks. Each block contains thirty 50-kvar 7200-volt single-bushing Elemex capacitors; each individually fused, in two series groups.

Each phase contains eighteen series groups in nine blocks for a voltage of 129,600 per phase to neutral.

Since the neutral is solidly grounded, graded base insulation is used—196 kv porcelain under the incoming line stack; 69 kv under the middle stack; and 15 kv under the third stack. Notice also the corona rings on all blocks of the incoming line stacks at the right.

Let L-M Engineer YOUR Banks

Call on the L-M Field Engineer for anything from a 3 kvar secondary capacitor to the largest bank. He can provide literature, and tell you how to get L-M application engineering service. Or write Line Material Industries, Milwaukee 1, Wisconsin.



TYPICAL L-M BLOCK OF Elemex capacitors. Block is assembled and wired at the factory, ready to install. L-M was the first with 50 kvar capacitors and a leader in the engineering of pre-wired blocks and pole-type racks, which can be supplied with or without oil switches mounted on the rack.

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LINE MATERIAL Industries *Elemex*® **Capacitors**

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

McGRAW EDISON

Editorial Comment

FEBRUARY 2, 1959

Westinghouse's 'Total Electric Home': A Giant Step

With the advent of Westinghouse's "Total Electric Home" program, (EW, Jan. 19, p. 32), electric heating and cooling is likely to take a giant step forward. Westinghouse developed this program as a means of assuring that the rate of residential load growth will not decline in the next decade or two. Said Vice President Chris J. Witting, ". . . We think electric heating and cooling and all the other things it will carry along with it can close the gap between our forecast and the historic rate of growth."

We are, of course, delighted that a company the size of Westinghouse, with its facilities and prestige, has decided to throw its weight behind electric heating and cooling. We believe that the load has reached that stage of development at which precisely this kind of action is needed. We would like now to sketch the implications of such a program for utilities—especially those utilities that have been dragging their feet when it comes to electric heating and cooling.

Westinghouse is going to promote its Total Electric Homes nationally in magazines such as LIFE, and on network television with its Desilu Theater. The effect of this kind of promotion is going to show up very soon locally. People are going to become interested in electric heating, particularly when the "higher cost" block in their minds is broken down. They are going to ask questions, and they are going to ask them, not of Westinghouse, but of their local utilities. And their local utilities had better have some constructive answers ready.

In other words, the effect of Total Electric Homes in combination with that of other national programs—such as EEI's National Electrical Living Program—will be to place the electric heating load on utilities systems whether they want it or not. This has happened with other loads, and the utilities, by opposing what the public was clearly ready for, were inevitably the losers.

It is time now that they, too, take the giant step.

To Help You Get More from AIEE Meeting

The current Winter General Meeting of the American Institute of Electrical Engineers is a record-breaker. More than 600 technical and conference papers are scheduled to be presented and discussed during 140 sessions. This amounts to better than four papers at each of 15 sessions during any one morning or afternoon.

Engineers attending the meeting have some advantage over those who are missing it. But even those present are finding themselves hard pressed to decide upon the particular simultaneous session to attend. The decision is complicated by the concurrence of a pertinent field trip.

The size of the Winter Meeting, and the importance of the contemporary thinking disclosed there both require special editorial attention. Thus, Electrical World has seven of its full-time editors on the scene to gather a story tailored for electric utility readers. Each of these editors will report on technical sessions that fall within his engineering sponsorship. Whether you are attending the meeting or not, we hope this timely and comprehensive coverage scheduled for the March 2nd issue will help you get more from this important industry meeting.

In hard-hit Pennsylvania and Ohio cities . . .

Utilities Escape Brunt of Flood Havoc

The floods, ice storms and snow that hit sections of the East and Midwest last fortnight inflicted relatively slight damage on power companies. Where outages occurred, they were of short duration. Plants, substations and other facilities were hit only superficially on most systems.

Biggest impact on Ohio and Pennsylvania utilities came from lost industrial revenue. West Penn Power Co's industrial load dropped about 5% as plants along the Allegheny River were flooded and shut down. The utility's largest customer, Allegheny-Ludlum Steel, was among these.

Industrial Load Drops

A West Penn spokesman estimated that industrial energy use was off a total of 2¼-million kwhr for the three days ending Jan. 23.

The new Armstrong Steam Station's output was curtailed when ice jams tore away trash racks and circulating water screens, West Penn said. Condensers fouled by trash and mud also caused reduced operation at the company's Springdale plant. The Freeport boat rescue shown above took place on West Penn's system.

Pennsylvania Power Co's headquarters community of New Castle was among the hardest hit by the flood in Pennsylvania. Company facilities, however, were hardly affected. In Sharon, the utility's biggest customer, Sharon Steel, and other industrial customers in low-lying areas were flooded. Westinghouse Electric Corp's transformer works were not affected by the flood, which in Sharon was the worst since 1913.

A few isolated cases of trouble occurred on Pennsylvania Power's system. In Greenville some 400 to 500 customers were blacked out for a brief period when a pole was washed out. Several hundred meters were removed to prevent flooding.

Duquesne Light Co experienced only minor difficulties. There was some trouble with debris accumulating on trash racks at generating stations along flooded rivers. A company owned coal mine was shut down due to a shortage of barges, which were hung up in ice-choked rivers. This didn't affect generation, though, since coal stocks were ample.

Flood damage to utilities in Ohio was spotty, with the heaviest concentration of damage and losses coming from the mid-central and southern sections of the state.

Toledo Edison Co reported only minor difficulties, outages only where requested by authorities, and little revenue loss.

Ohio Edison Co suffered nominal damage to property and nominal loss of revenue. Outages amounted to only one-third of 1% of total number of customers.

The underground network of Cleveland Electric Illuminating Co incurred damages estimated by the company at $45,000. About 1,500 customers were without service at one time or another because of feeder failures; most of these were restored within 45 min, the company said. Repairs on poles in the inundated suburb of Valley View brought CEI's first amphibious transport of linemen.

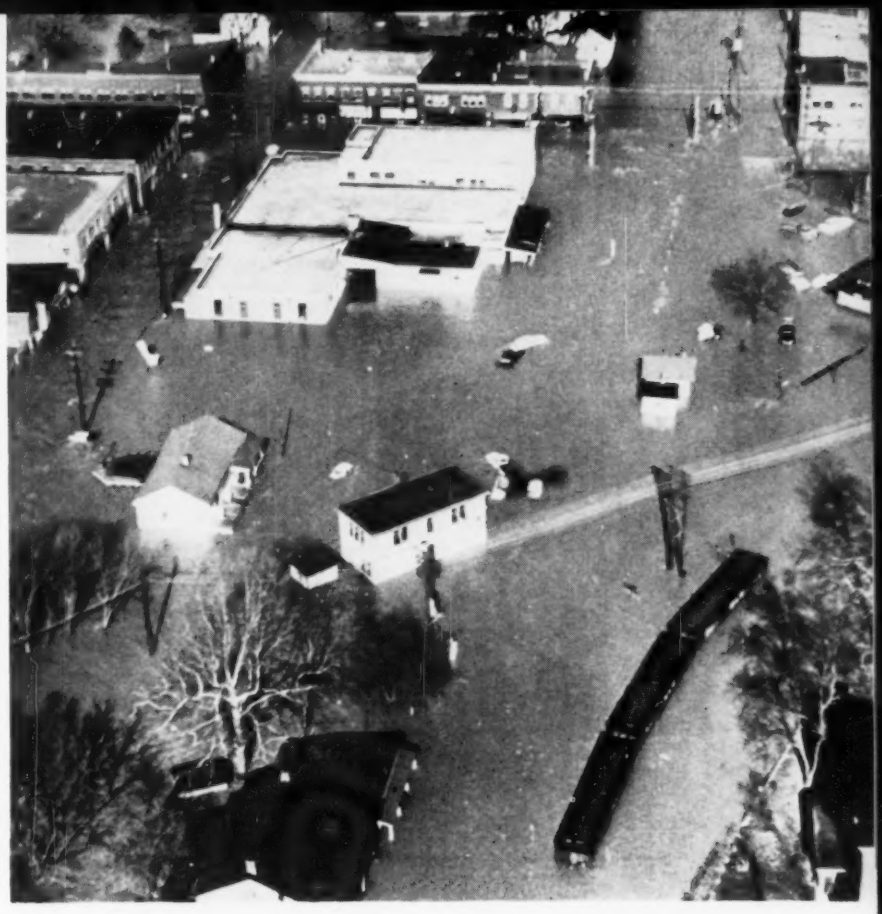
Helicopter Comes to Rescue

A helicopter flew in supplies and picked up an ailing worker at Columbus & Southern Ohio Electric Co's Pickaway plant when the overflowing Scioto River isolated the plant and washed out roads and rail access. The station is operating and truck routes have been reopened. The company made 868 individual calls on Jan. 21 to disconnect meters.

Cincinnati G&E said there was no trouble on its system.

The St. Louis area served by Union Electric Co and sections of Illinois Power Co's system felt the sting of a Jan. 21 ice storm.

Union Electric had a total of about 30,000 customers blacked out over Jan. 21-22, but never more than 15,000 out at any one time, the company said. Outages ranged from 30 min to 4 hr. Damage to the system was described as temporary and superficial. Four distribution substations were knocked out. Also a sub-transmission station went out and in turn knocked out four sub-



LOVELAND, OHIO, near Cincinnati, was paralyzed by Little Miami overflow

stations in North St. Louis County.

About 50 Union Electric men went to the aid of the company's subsidiary, Missouri Edison, which had difficulty at three Missouri towns, Troy, Wentzville and Warrenton. Large sections of the three cities were blacked out for from 4 to 12 hr. Union Electric also sent about 60 men to Decatur and the Champaign-Urbana area to aid Illinois Power.

In New York State, Niagara Mohawk Power Corp reported no difficulties except for an isolated pole or two being undermined.

A squall that left 3.91 in. of rain in the Chattanooga area Jan. 21 caused some interruptions and prompted TVA to control the flow of Tennessee River tributaries.

The Chattanooga Electric Power Board established "fairly normal" service the day after the squall, which knocked out several feeders and substations. Ft. Oglethorpe restored service to 3,000 blacked-out customers late on the night of the storm.

Curtailment Follows St. Lawrence Cable Failure

One single-phase section of 34-mi, 69-kv link goes out in deep water, pressure from piled ice knocks out another

Power is still curtailed in the Gaspe and eastern Quebec Province following failure of the 34-mi submarine crossing of the St. Lawrence River. Loss of this 69-kv cable left Lower St. Lawrence Power Co at Rimouski and the mines and co-ops of Gaspe, 141 mi to the east, dependent upon a few small local generating plants. Their normal supply is from the Quebec Commission's hydro plants north of the river, with up to 35 Mw flowing through the cable.

Trouble began Jan. 9 when one single-phase cable failed in deep water. Commission personnel promptly cut in the spare cable to restore service. But a second failure Jan. 11 again cut off the link.

The second failure occurred in shallow water about 400 ft from shore where ice, piled up 30 ft or more, had to be removed for access. The ice accumulation may have been aggravated by the month-long battle to free 40 ships ice-bound in the river near Montreal. Damage to the second cable is attributed to the pressure of piled-up ice. Because of the severe weather, repairs are expected to be delayed at least a month for the shallow-water failure and longer for the one in deep water.

Diesel Units Sent by Rail

Emergency power was established by rolling about seven rail-mounted diesel units of about 1,000 kw each into the distressed area. Within about 36 hrs, three units were in service at Rimouski after a 400-mi trip from Montreal Subsequent units were sent on to Gaspe. Their output, supplementing that of existing local generation, is helping to relieve the curtailment imposed initially.

One of Longest Submarine Cables

The submarine crossing was one of the longest in existence when it was installed a few years ago. It comprises a single 37-strand copper conductor, 80 to 90 mi of impregnated paper, a rubber sandwich, and a lead sheath. Manufactured at Toronto, it was shipped to a temporary plant at Rimouski where it was spliced into 34-mi lengths, covered with bituminous material, and armored with 28 strands of aluminum alloy. Four such cables were installed, three of them to carry up to 75 Mw at 69 kv and the fourth as a spare. Installation was complicated by depths up to 1,200 ft, severe tidal currents, and adverse weather.

AEC's McCone Wants More Selectivity on Reactor Types

Top officials of the agency deny that a policy switch is in the works. Commissioner Floberg says it's too early for restrictions; Joint Committee on A-Energy reserves judgment

Signs are growing that this year's big decision on atomic power development will be whether the Atomic Energy Commission should reduce the number of reactor concepts in the program—and if so, by how much.

AEC Chairman John A. McCone has now declared himself on the side of those who say that nuclear power experts must shoot at fewer targets—a point of view which goes down hard with marginal reactor manufacturers who might thereby be forced out of the atomic business.

Debate Begins Feb. 17

The first public debate of the issue will come in mid-February when the Joint Congressional Committee on Atomic Energy opens hearings on the development, growth and state of the nuclear industry. The inquiry will begin Feb. 17.

To date, the AEC—feeling it's too early to settle on one or two reactor types as the key to competitive nuclear power—has carried out and supported research and development on a wide front.

Floberg Wants to Wait

But in recent weeks, reports have spread that AEC would support only a few of the most promising concepts. Top AEC officials deny such a policy switch has been made. Even Commissioner John Floberg, whose speeches have reflected his conviction that an ultimate narrowing of the AEC program is essential, told EW that it's too early to restrict the program to four or five reactor types.

Press conference remarks by Chairman McCone, however, show AEC is now studying the advisability of reducing the number of reactor concepts which can or should be pushed to the construction stage.

He says an AEC study made at his request shows that the government and private industry will have invested some $300-million over a 14-year period to make boiling water reactors reasonably competitive in high-cost areas of the U. S. —that is, at eight or ten mills—by 1965.

McCONE: Fewer targets

The lessons learned will benefit other types of reactors to some extent, McCone agrees. But he says the others still must go through the stages of research and development and successive construction of experimental, prototype and first-generation commercial-sized plants.

"This is a very expensive business," the chairman observes.

Britain's Approach Ruled Out

McCone predicts "some narrowing down of reactor concepts." Although ruling out the one-concept approach favored by the British, he expressed doubt that "we should proceed with every conceivable type of reactor concept that offers promise. . . (It must) do something that cannot be expected from other types that are under development and considerably advanced."

Key figures on the Democratic-run joint committee on atomic energy are reserving judgment until they see how much "narrowing"—if any—the commission recommends. They're ready to admit some narrowing of concepts may be necessary—but not too much.

"It's a matter of degree," says one committee source.

Contract Signed by AEC, Carolinas Virginia Group

The Atomic Energy Commission has signed a contract with Carolinas Virginia Nuclear Power Associates for a 17-Mw nuclear power plant. The agreement covers design, development, fabrication, construction and test operation of a heavy water-moderated pressure tube-type reactor fueled with slightly enriched uranium.

Capital costs of about $22 million will be paid by CVNPA for the Parr, S. C., plant. AEC's maximum cost will be $15,075,000 for research and development, and a five-year waiver on fuel and heavy water charges.

Stone & Webster Engineering Corp is architect-engineer for the project. Westinghouse Electric Corp will develop and furnish plant equipment. Target date for the plant's completion is June 30, 1962.

Index Available

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Turbine Award Protested

A $1,757,210 award by the Army Engineers to Baldwin-Lima-Hamilton Co has stirred protests by English Electric Co and the British government that the Administration has violated the spirit of the Buy-American Act.

The award was for two hydro turbines for use in the 64-Mw Greer's Ferry Dam in Arkansas.

Leo A. Hoegh, Office of Civil & Defense Mobilization director, recommended that Baldwin should get the award in the interest of national security, even though English Electric's bid was about 19% lower.

GE-NEMA Link Denied

In the back of many minds, however, is whether Hoegh's recommendation—though limited to a specific case—may have a bearing on the General Electric Co and National Electrical Manufacturers Association petitions, now pending before OCDM, which call for an end to all heavy electrical equipment imports. Hoegh insists his Baldwin decision has no relationship to the GE-NEMA petitions. A general decision on the GE-NEMA brief is expected within one month.

Hoegh's recommendation was based on the ground that loss of the contract might force Baldwin to close its Eddystone plant, just outside Philadelphia, thereby costing the government use of the plant—including heavy "elephant" machine tools—in case of an emergency.

English Electric, however, told Hoegh, "The level of hydraulic turbines constitutes no threat to the stability of the U. S. industry as a whole, or to Baldwin-Lima-Hamilton Co in particular, or to maintenance of their productive facilities and tools. The industry is, in fact, operating at historically high levels."

English Electric also charged that closure of the Eddystone plant would not mean the destruction of the "elephant" tools; they would be transferred to other plants.

Under the Buy American Act, a domestic supplier may win a government contract away from a foreign supplier even though the domestic bid is up to 6% higher. And in economic "distress" areas, as in the Baldwin case, the act permits the domestic bidder to win the award if he is up to 12% higher than the foreign concern.

Since Baldwin's bid was about 19% higher, English Electric has complained that the Administration "changed the rules in the middle of the game." Actually, OCDM may depart from the 6 and 12% differentials where there is a "clear showing" that an award to a domestic firm is in the nation's interest.

Study Starts on BPA 'Dump' Energy Sale

Bonneville Power Administration and Pacific Gas & Electric Co officials sat down Jan. 13 in San Francisco and began discussions which could lead to use of federal "surplus dump" power from the Columbia River system as California steam displacement.

The first meeting, which confirmed the definite but yet unofficial interest by both parties, will be followed by staff studies to determine overall economic feasibility of the basic idea, and method of transmission to be utilized.

Presently the BPA transmission grid is separated from the PG&E system by the growing network of the California Oregon Power Co. According to a BPA spokesman, the plan would entail negotiations for wheeling the power "over intervening facilities"—which could only mean Copco's.

BPA has been careful to emphasize the power in question is that "which is otherwise unmarketable and would go over the spillways if not sold." One of the mutually beneficial features of this power is that its periods of greatest availability match well with PG&E's periods of best utilization for it. But there probably will be no guarantees as to its availability.

About 145 airline mi separate BPA's southernmost 230-kv transmission at Yamsay, Ore., and PG&E's nearest 230-kv lines at the Pit River hydro development in California. But this gap is narrowed to about 90 mi by Copco's 230-kv from Yamsay to Klamath Falls, Ore.

Copco and PG&E already interconnect over other routes at 115 kv, but in the past Copco has operated its system split, preventing interchange between its two neighbors.

Under median conditions, BPA would have about 12-billion kwhr of "surplus dump" energy available in each year through 1962, and about 7-billion yearly through 1968.

Alcoa and Rome Cable Plan Merger

Rome Cable Corp, 23-year-old manufacturer of insulated wire and cable products, and Aluminum Co of America have announced plans to merge. Subject to Rome shareholders' approval, Alcoa will acquire the firm for 355,226 shares of Alcoa common stock.

Present members of Rome's management will stay at their jobs in a new company to be called Rome Cable Co. H. T. Dyett will retire as Rome Cable board chairman if the merger is approved March 25. He previously planned to retire in June. Dyett will continue to serve on the new firm's board.

Rome has averaged $47 million in annual sales during the past five years. It has about 2,500 shareholders and 1,500 employees.

According to Frank L. Magee, Alcoa president, "Rome Cable's complete facilities for the production and sales of many types of insulated wire and cable, as well as bare copper conductors, will fully complement Alcoa's facilities and enable the new organization to meet the increasingly complex requirements of the electrical industry."

Said A. D. Ross Fraser, Rome president: "The coordinated research and development activities of Rome and Alcoa will provide improved services to the electric industry." The proposed affiliation "is very much in the best interest of Rome's employees, shareowners, and customers," he said.

3 Engineering Societies Focus on Merger Plan

Engineers Joint Council might become American Engineers' Association, if proposal is ok'd; Westinghouse, Carnegie Tech cited

WESTINGHOUSE SCHOLARSHIP PROGRAM citation is accepted by Dr Teare, left, Carnegie Tech, from EJC Pres Needles. Westinghouse VP J. A. Hutcheson looks on

Plans for merging Engineers' Council for Professional Development, Engineering Manpower Commission, and Engineers Joint Council were the focus of EJC at its annual meeting Jan. 16 at New York.

A resolution read by A. B. Kinzel, EJC co-chairman of the Ad Hoc Committee on Amalgamation, proposed that EJC, Inc., change its name to a more general one such as American Engineers' Association, Inc. Present EJC personnel would function as a division of the new corporation. ECPD and EMC would likewise become divisions, thus retaining a parallel status with EJC. The existing EJC charter is broad enough for such reorganization, the committee advised, provided appropriate by-law changes are made.

Final action on the resolution was deferred. But acceptance seems probable in view of replies of EJC member societies to a survey.

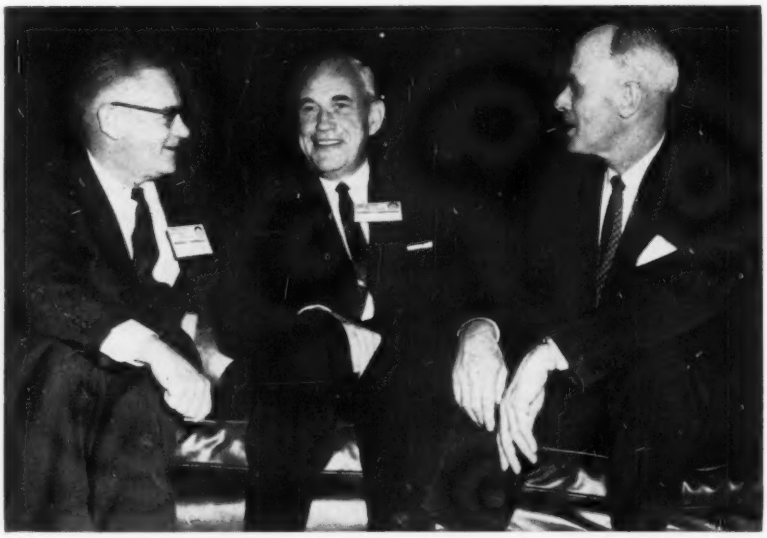
Another merger would create the American Society of Heating, Air Conditioning, and Refrigeration Engineers from the ASHAE and the ASRE, effective Feb. 2. Both societies are constituents of EJC.

Feature of the meeting was presentation of a citation to Westinghouse Educational Foundation and Carnegie Institute of Technology. It was accepted by Dr J. A. Hutcheson for Westinghouse and Dr B. R. Teare for Carnegie Tech. It lauded a scholarship plan begun in 1939.

EJC Pres E. R. Needles, in presenting the citation, noted its "great contributions to the lives of 139 scholarship winners."

Dr Hutcheson announced an offer by Westinghouse to donate to most accredited college electrical engineering departments a laboratory device to help teach modern concepts. This device includes two small drive motors, a torque meter, and a motor-generator, all on a single shaft. With it, he said, "it is possible to duplicate any situation involving rotating machinery and to study static and dynamic characteristics."

Women Get Pat on Back at LBE Conference

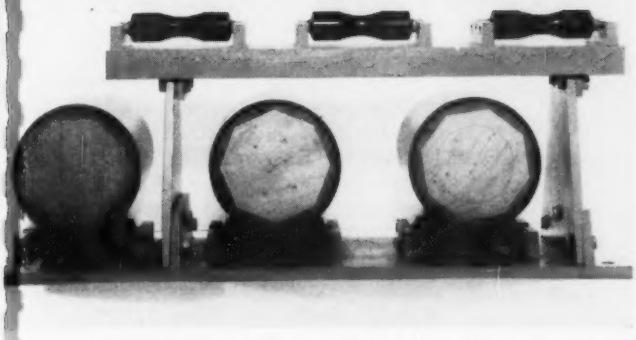


PLAUDITS FOR LOAD-BUILDING ENDEAVOR were given women conferees by guest speakers, l to r, E. J. Hurley, Detroit Edison Co, R. D. Furber, Northern States Power Co, and R. G. MacDonald, West Penn Power Co

Guests at the third Live Better Electrically Women's Conference, held in Chicago, Jan. 7-10, and sponsored by Edison Electric Institute, were told, "You are definitely a part of the team . . . striving for better understanding on the part of our customers and allies of the private enterprise system." With these remarks, Robert McDonald, EEI Residential Group Chairman and West Penn Power Co vp, encouraged the audience, made up of utility home service directors, appliance manufacturer personnel, educational, advertising, and press representatives, to continue selling electrical living.

"You have long been aware that customer relations are the most perishable commodity in our business, and you certainly work hard at maintaining and improving this

(*Continued on page* 79)



INITIAL PIPES, shown in model, will rest on rollers. A mid-bridge anchor will minimize expansion, contraction effect

SIX 69-KV FEEDERS will be laid in abandoned trolley lanes of bridge. Grating roadways will cover cable pipes

Trolley Lanes to House Bridge Cables

The half-century-old Queensboro Bridge will carry 69-kv cables connecting substations to be erected on each side of the East River, Consolidated Edison Co of New York, Inc, has announced. The cables will link a Queens substation with two Manhattan substations.

The Queensboro, built along with the Williamsburg Bridge in 1909, has only one predecessor spanning the East River, the Brooklyn Bridge which dates from 1883. Often mistaken for a suspension bridge because of its high piers and general appearance, the Queensboro is actually a cantilever type, having three separate rigid sections. Due to its rigid cantilever construction, the bridge transmits to all parts of each section the vibration set up by the constant flow of traffic.

8-in. Dia. Pipes Will Hold Cables

The 69-kv cables will be in 8-in. dia pipes on both sides of the bridge within the lanes abandoned by the old bridge trolley line. As each lane ultimately will have six cables, provision will be made for adding three cables to each lane.

The old trolley rails, as well as gratings and interfering steel work, will be removed, and ductile iron pipe supports will be installed on cross members. These supports' thiokol-coated rollers will protect the pipe coating of glass reinforced epoxy and insulate the pipe from the bridge. These provisions are expected to make maintenance practically negligible.

Each pipe, welded into a continuous length, will rest on the rollers and will be anchored at the middle of the bridge. This arrangement will minimize the effect of expansion and contraction on the bridge, as the pipe's independent movement will neutralize thermal forces. There will be anchors at the base of the piers also. The pipe will be allowed to move as much as 2 ft horizontally and 1 in. vertically at the top of the pipe riser bends. Pipe elongation will be controlled by a guide on the pier face and by spring-loaded rollers and hangers.

Bends Maintain Tension in Dip

A dip in the run will take the pipe under a driveway ramp which leads from the bridge's main roadway to an elevator building on Welfare Island. Large-radius bends at this point will keep the tension applied to the cable within permissive cable pulls when these pulls are exerted across the river in a single run on the horizontal portion of the bridge. Splice positions will be near each riser pier.

Initially, three 2,000-MCM, paper-insulated, 69-kv, gas-filled cables will occupy each of four pipes, three on the north side and one on the south. The other two pipes on the south side will remain vacant at first.

The pipes will be electrically insulated from the bridge by special construction at the anchorage and guidance structures. Thermocouple pads, whose leads will be brought to normal ground level for easy access, will instrument close checks on the heat characteristics of the conductors.

Grating roadways, capable of carrying 15-ton vehicles, will be placed over the pipes on each side of the bridge. Clearance and ventilation will be sufficient for the installation of all initial and future pipes. The roadways will be about 6,000 ft long by a nominal 12 ft wide, one on each side of the bridge. The roadways will have turnouts for disabled vehicles and emergency exits to the main roadway.

The project will involve Con Ed in road building. As part of an agreement with the city, the utility will construct both roadways at its own expense up to a fixed cost maximum of $3-million.

Tight Gallery Affects Splicing

As six pipes will be clustered in a gallery less than 4 ft wide and 2 ft high, cable splicing operations must be performed above the gallery. Sufficient space will be obtained by bending the pipe within the natural flexure of the steel, after which it will be returned to its normal position. Of necessity, the location of cable splices in adjacent pipes will be staggered.

The approximate weight of the pipes and supporting brackets will be 350 lb per ft of length across the bridge. The grating roadway above the pipes will weigh another 350 lb per ft of length, so that roughly a 2,000-ton load will be added to the Queensboro Bridge by this construction.

Local Back-Up Relaying Protects

Single-step impedance relays provide back-up tripping of individual bus sections in 115-kv substation. Scheme lessens chance of loosing excessive generation at 325-Mw station

K. K. DOLS, Relay Operating Engineer, Northern States Power Co, Minneapolis, Minn.

Local back-up protection added to a steam station 115-kv ring bus will lessen the chance of loosing an excessive amount of generation on the system of Northern States Power Co. Single-step back-up relaying for the substation will limit back-up tripping to individual bus sections.

This scheme was prompted by a rise in installed capacity at High Bridge station. Consequent higher fault current capability made difficult the use of remote back-up relaying on the 115-kv lines from the station bus. Although coordination of the single-step impedance relay has been successful at High Bridge, future installations will use multi-step units to avoid excessive back-up relay time.

High Bridge station represents 30% of the system's generating capability. Total capacity of 325 Mw includes three units totalling 143 Mw connected to the 13.8-kv bus. Unit 4 with a 65-Mw capability and Unit 5 with a 117-Mw capability normally are connected to the 115-kv bus. Unit 6 rated 156 Mw is scheduled for completion this year.

Four outgoing 115-kv lines have directional comparison relaying; the fifth has a pilot-wire relay. With primary relays out of service, all lines are protected by three-step impedance relays and directional-overcurrent ground relays. Three bus sections are included in the differential protection for the transformers on the respective sections. The other two bus sections are protected by multiple-restraint differential relays.

Relays on the 115-kv lines provide remote back-up for adjacent stations except for those adjacent stations having local back-up. Overcurrent relays on the 13.8-kv side of two 115/13.8-kv banks trip the 13.8-kv bank breakers and provide back-up for the 13.8-kv bus.

Complete back-up of a given line breaker requires separate current and potential transformers for the

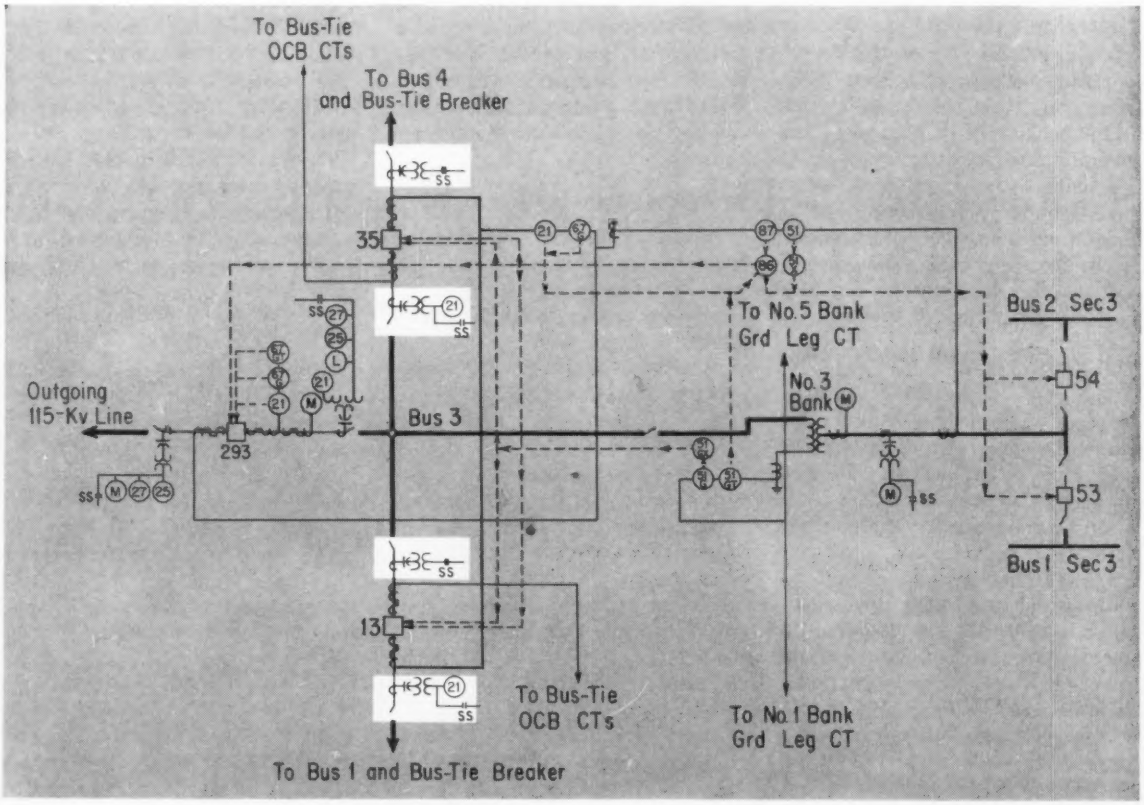


FIG 1—SINGLE-STEP IMPEDANCE RELAYS are installed for phase back-up to provide a simple means of positive time coordination. In this scheme for a typical bus section, currents through bus-tie breakers provide backup intelligence

System

back-up relays, a circuit breaker other than the line breaker, a separate dc source, and back-up relays. To provide complete back-up at High Bridge station, the required separate breakers and current transformers were available in the bus-tie breakers. Thus, only the back-up relays, a potential source, and a separate dc source had to be added.

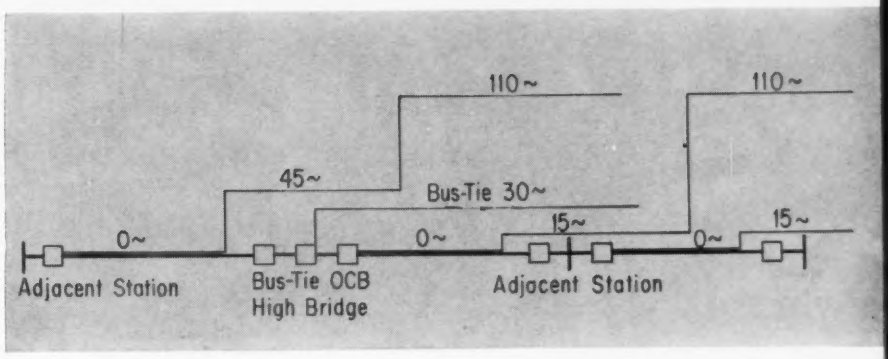


FIG 2—**SECOND-ZONE TIME** of single-step relays is acceptable on High Bridge bus because faults are infrequent and outage time of pilot relaying is low

Provides Positive Coordination

Because step-type impedance relays were in each line, a single-step impedance relay was installed for phase back-up. This relay provides a simple means of positive time coordination and requires minimum panel space. A directional overcurrent ground relay coordinates with the ground relay on the lines. Currents into each section through the bus-tie breakers were added and used for intelligence for the line and ground back-up relays. Typical bus section relaying for the 115-kv substation is shown in Fig 1.

Each bus-tie breaker originally had a single-bushing potential device on each side for synchronizing. To provide separate potential intelligence for the back-up relays, two bushing potential devices were added to one side of each bus-tie breaker. While separate batteries were available, a separate dc source would have required additional auxiliary tripping relays. So, only a single battery source was used to avoid circuit complication.

Impedance and ground relays trip the two bus-tie breakers, the bank breakers and the line breaker. Impedance relays see the end of the line on respective bus sections using apparent impedance values. Second-zone tripping time of the line relays is 15 cycles; bus-tie impedance relays trip in 30 cycles. Therefore, second-zone tripping time of relays looking into High Bridge bus must be 45 cycles. Directional ground relays are coordinated similarly.

Ground relays on all lines looking into the High Bridge bus are coordinated with the relays in the 115-kv neutral of each transformer. This provides the necessary back-up if a line breaker fails to clear a fault. In addition to this protection, this scheme furnishes back-up for the bus and bank differential relays. Because the same breakers are tripped and the same current transformers are used by both relay schemes, back-up relaying is provided only for the bus and bank differential zones.

Protection was desired against loss of the ring bus upon failure of a bus tie breaker to clear a fault. However, probability of a bus fault-breaker failure combination is so remote as to warrant only low-cost protection. Therefore, two overcurrent relays installed in the 115-kv neutral of each transformer coordinate with each other and with ground relays on each bus section.

One or More Breakers Trip

Should a bus breaker fail to clear a fault, the first of the over-current relays operates and trips its associated bus-tie breakers. Depending upon the type of fault and which breaker fails to clear, one or all bus-tie breakers will trip.

Tripping of the bus-tie breakers restricts the fault at most to two bus sections. The second overcurrent relay on the faulted section then "times out" and trips bank and line breakers to clear the fault. Additional phase protection was not provided. The possibility of a bus fault not involving ground is remote and the cost of providing the necessary current and potential intelligence is high.

Local back-up protection adds one step in the time coordination of relays at adjacent stations. With pilot relaying on all lines, tripping time normally is not affected with primary relaying in service. Because faults are infrequent and outage time of pilot relaying is low, this increased second-zone time of relays looking into High Bridge is acceptable. Time coordination of single-step impedance relays on lines on the High Bridge bus is shown in Fig 2.

The increasing number of tapped loads on transmission lines has made local back-up protection a must for all new substations on the Northern States Power system. With the directional relays looking into the bus section and with only the bus-tie currents added, the value of line impedance seen by the relays depends upon whether a generator is on the bus. If a line from High Bridge bus connects to an adjacent station having short lines, it is possible for the change in impedance to cause the back-up relays to overreach the second zone of the line relays. This would make the back-up relay time excessive. Thus, for lines not protected by pilot relaying, use of the two-step impedance relay will result in faster tripping time by the second zone of the primary line relays.

Adjust Zone Time Setting

The three-step impedance relay will be used in stations with more than one line into each bus section. Use of one or two-step impedance relays may result in an excessive time setting on the second zone of the relays looking into the protected bus. Three steps may be provided on a standard relay by modifying the timer so that each zone has an adjustable time setting.

Utilities

• Little-known halogen compound may replace oil or air in circuit breakers and switches in future installations

46-KV RECLOSING circuit breakers are of self-generated gas blast type. They have one pressure-generating break and one interrupting break per phase

A. P. STROM, Supervisory Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.

Sulfur hexafluoride (SF_6), although new to the circuit interrupting field, may replace oil or air as the arc-quenching medium in circuit breakers and switches in the future. The inert, non-toxic, nonflammable gas has a high dielectric strength and excellent arc-quenching properties. A little-known halogen compound, SF_6 is the subject of growing utility interest.

SF_6 has a density about 5 times that of air. Its dielectric strength at 30 psig is about equal to that of a good insulating oil. At higher pressures its dielectric strength may greatly exceed that of oil, and for any given pressure it is generally 3 to 5 times that of air.

Its outstanding characteristic, however, is its arc-quenching ability. In a plain-break interrupter, about 100 times as much current can be extinguished in SF_6 as in air. When the SF_6 is blown through the arc, even at low velocities, the effectiveness as compared to plain-break is further multiplied up to hundreds of times.

Normally a gas, SF_6 can be liquified at moderate pressures and stored as a liquid at its vapor pressure in much the same manner as carbon dioxide. The gas is stored and shipped in standard size (1.5 cu ft) steel cylinders normally holding 100 lb of SF_6. The vapor pressure, which is about 330 psig at 75 F, varies with temperature. A 100-lb cylinder contains enough gas to fill a volume of about 250 cu ft at one atmosphere.

The cost of SF_6 at 30 psig is comparable to oil. Generally the volume of gas in an SF_6 breaker is smaller than that in an equivalent oil breaker, comparing more nearly to volumes in oil-poor breakers.

Not Discharged to Air

Because SF_6 is relatively expensive compared to compressed air, it is contained in sealed chambers and is not discharged to the atmosphere as in air blast breakers. The benefits of sealing largely offset the added difficulty and costs of sealed construction. The absence of flame and greatly reduced noise even on high power short circuit interruptions make sealed breakers especially desirable for indoor operations. Sealing also avoids the deleterious effects of corrosion and insulation leakage due to moisture condensation.

Arc chambers may be constructed of any insulating material. Organic insulation is generally located to avoid contact by arcs or hot arced gases, to eliminate the possibility of hydrogen from the insulation combining with momentarily released free fluorine to form hydrofluoric acid. Interrupting orifices are usually made of Teflon, because it is very resistant to arcing and contains no hydrogen.

It is usually convenient to fill the arc chamber directly from the high pressure SF_6 cylinder, after first evacuating the chamber. The proper filling can be determined by observing a pressure gage.

Although a vacuum pump is normally used for removing air from the arc chamber prior to filling, a high vacuum is not required. It is sufficient to pump down the arc chamber to a few millimeters pressure, rather than the usual microns. Actually, several percent of air can be introduced before a noticeable decrease in dielectric strength or interrupting performance occurs.

A displacement method may be used for emergency filling in case a vacuum pump is not available. Because SF_6 is much heavier than air, it can be introduced at the bottom of the chamber and will displace air, which is vented through a port at the top of the chamber. A gas flame or lighted candle placed in the escaping gas will be extinguished when SF_6 begins to escape.

While the presence of some air or moisture in the SF_6 does not appreciably affect its interrupting ability, tests indicate that excessive moisture may increase the very minor amount of decomposition products formed during arcing. The breaker chambers are, therefore, provided with a bag or container holding activated alumina. This insures the dryness of the gas in the arcing chamber and also absorbs the decomposition products formed during arcing.

Even in high power breakers,

Study SF_6 as Interrupting Medium

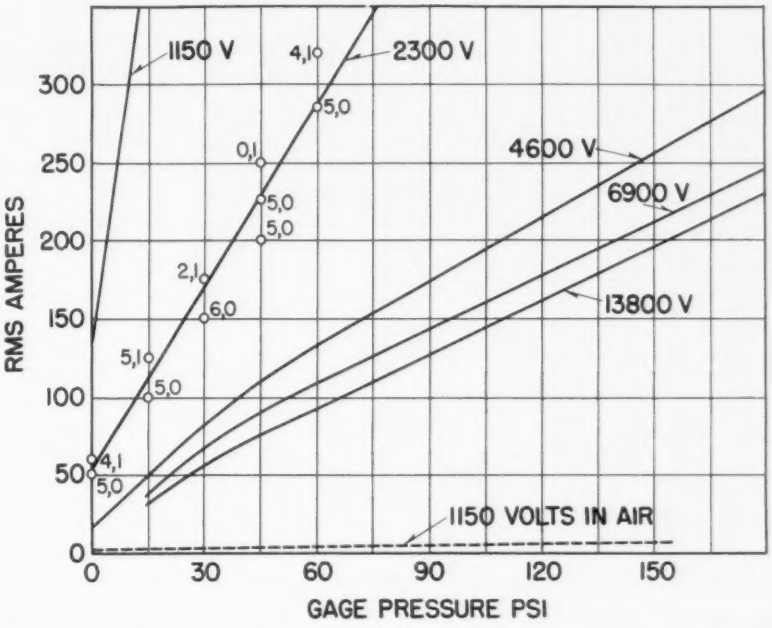
many interruptions at maximum short circuit rating can be made before appreciable decomposition occurs. This low decomposition rate is possible because most of the decomposed gas immediately recombines to form SF_6. The stable SF_6 is not absorbed by the alumina, while the lesser fluorides produced during decomposition are quickly absorbed.

A few pounds of alumina will absorb all the arc products formed during the life of a set of contacts. The saturated alumina can then be discarded and replaced at low cost.

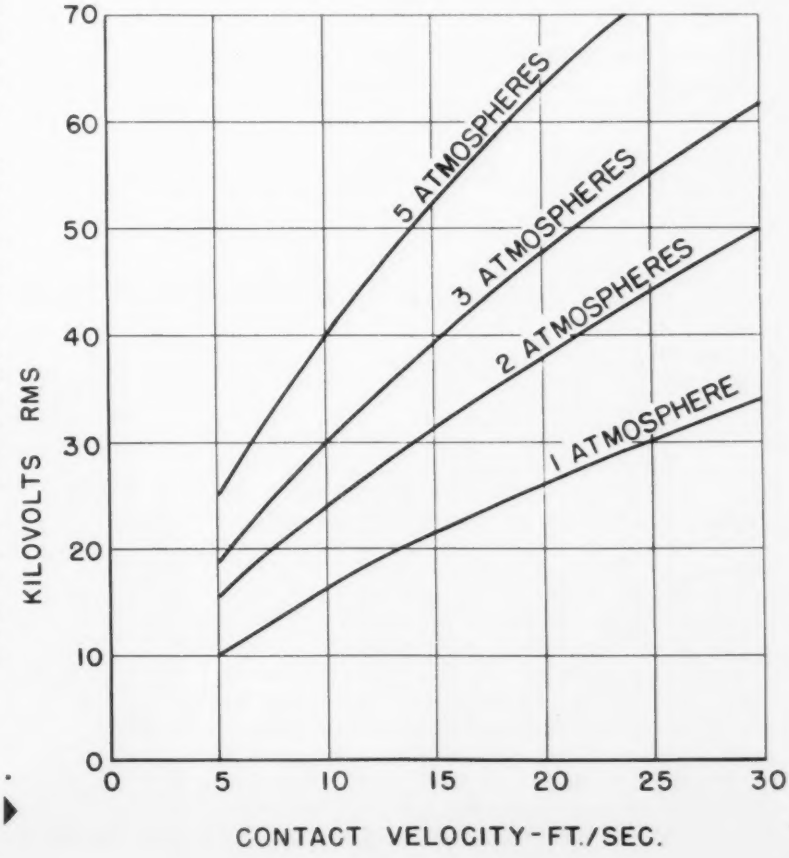
A special low permeability rubber gasket assures negligible diffusion of gas during the life of the interrupter. Although leakage can usually be detected with the customary soap bubble test, portable and reasonably inexpensive detectors particularly sensitive to halogen gases are available. Work is in progress to adapt these particularly to SF_6. The halogen detectors are much more sensitive than soap bubbles and are convenient to use because they have a "sniffer" tube that can be moved to any location where a possible leak might be suspected. No leakage of consequence has yet been observed in commercial circuit breakers.

For small interrupters, the cost of the gas is so small that it may not be worth saving when a breaker is serviced. As larger breakers are built, however, reclaiming of the used gas becomes desirable. Many systems could be designed for removal and storage of SF_6 during servicing. One method is pumping the gas from the breaker into a high pressure cylinder at a pressure above the vapor pressure at the prevailing temperature, thus placing it in a liquid state in storage.

The high dielectric strength, remarkable arc quenching ability over a wide range of current and voltage, and ease of handling make SF_6 a real competitor for oil and compressed air for use in high power switchgear.



100 TIMES as much current can be extinguished in SF_6 as in air with plain-break interrupter. All curves show values for SF_6 except bottom, which is for air



CONTACT VELOCITY varies with RMS voltage for different pressures

Two-Way Radio Speeds Stores

Two-way radio communication gives greater speed, coordination, and flexibility to operations at the Astoria cable and transformer storeyard of Consolidated Edison Co. It was put into effect by the Purchasing Department's stores bureau as part of a general improvement in techniques for handling safely and controlling the storage of some 6,500 cable reels and 2,000 transformers.

Two-way radio has proved so advantageous an adjunct to the safe and efficient operation of the storeyard that the bureau has begun a study of its practicability at other locations. It is seeking to determine whether the use of two-way radio will add speed and flexibility to other operations involving the bureau's fleet of 55 fork-lift trucks.

Two-way radio enables the storeyard control office to keep in constant touch with the yard equipment. Through its use, fork trucks now carry a full load while traveling to and fro. Orders are radioed to pick up new reels for storage and on the return trip to pick up the specific reel for field use.

Formerly, a 25 to 30-min interval elapsed between the time a crane was required and the time the operator reached his destination. Today the dispatcher contacts the operator in seconds.

To assist the dispatcher, the stores bureau designed a master control board. A glance at this board informs the dispatcher of the location of any reel or transformer in the storage area. Upon delivery of a new reel, he selects from the control board the appropriate space for the reel received and radios this location to the receiving clerk.

A three-way, perforated form is then filled out at the receiving platform with the location and reel number on all three parts. One part is stapled to the reel, and the other two are forwarded to the dispatcher, along with the shipping papers. The dispatcher places one part of the form in the control board and files the third in a reel numerical record file. Thus a three-way, fool-proof system is in operation for every reel. The same procedure is followed for transformers on delivery.

In the past, orders for reels and transformers to the yard equipment were carried by dispatchers on foot from the control office. The dispatcher then located the items for pick-up by mobile cranes. This procedure was part and parcel of the manner of storing many reels or transformers in the large storage bays 30 to 40 ft wide. When the items had been located and marked, orders were passed on to the cranes to lift them out to the roadways. There they were again picked up and later loaded on the field trucks. This procedure was time consuming, as the dispatchers and cranes worked over an area of some 400,000 sq ft. The improvement of

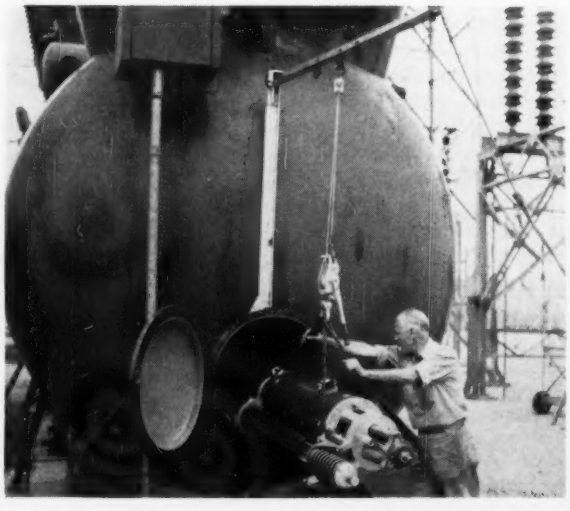
Jib Crane Handles Interrupters

M. L. FERGUSON, Senior Substation Engineer, Ohio Valley Electric Corp, Madison, Ind.

An inexpensive jib crane, built from scrap materials, safely handles fragile 550-lb 345-kv oil circuit breaker interrupter units for Ohio Valley Electric Corp. The crane reduces manpower requirements while overcoming the safety hazard of working in limited space near high voltage equipment.

The jib crane consists of two pieces of 3 x 3 x $\frac{5}{16}$-in. angle iron. The vertical piece is bolted at the bottom to the top of the breaker manhole flange. An auxiliary plate holds the center of the mast to a lug on the breaker tank. A 1-in. steel rod through a formed steel box serves as the pivot point on which the jib arm rotates.

Formerly, six men were needed to safely guide an interrupter in or out of the breaker tank. Three men, using the home-made crane, can now move interrupters from a truck bed into proper position. Total cost: $15.



s Handling

communication was a logical step in a general program of modernization.

Once undertaken, the modernization program pointed directly at the practicability of its extension to storeyard communication. Two-way radio was tried experimentally as a means of simplifying the dispatching procedure and reducing the time for transmitting orders from the control office to the new fork-lift trucks. Portable, low-power, battery-operated units from the 41st Street toolroom were installed in the control office and on the fork-lift trucks.

Experience with these units led to the bureau's desision to put in two-way radio permanently. A review of the requirements under operating conditions was made by the outside plant bureau, Electrical Engineering Department, by personnel directly interested, and by New York Telephone Co, which provided the radio facilities. The operation of several low-power radio installations with functions similar to those of the units on trial were observed.

Final selection settled on a low-powered radio equipment comprising a packaged receiver-transmitter-power supply assembly. Through simple modifications, these sets operate on 120 v ac or 6 to 12 v dc. Selection of this equipment was prompted by its adaptability to operation on commonly available sources of power supply, as either portable or stationary self-contained units. Battery replacement is not a problem.

Six fork-lift trucks are outfitted with units for 6-v operation, and 120-v ac units are installed in the control office and cable coiling storeroom. The equipment operates on a frequency of 33.14 mc and under FCC station License KA 3468.

FORK-LIFT TRUCK operator can acknowledge instructions given him by the dispatcher in storeyard central office

Portable Meter Base Speeds Surveys

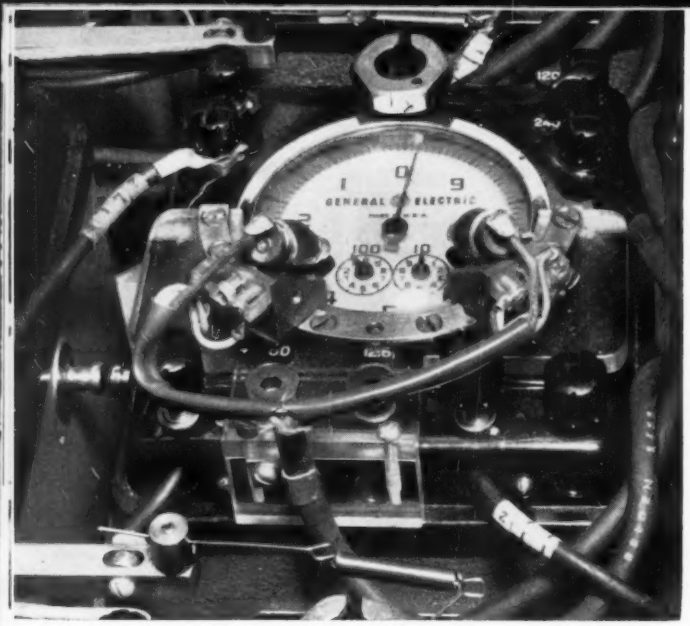
WILLIAM G. SIMPSON, Distribution Technician, Idaho Power Co, Boise, Ida.

A standard meter socket equipped with a chain hamstring clamp constitutes a portable meter base quickly installed on distribution poles. During peak load season, Idaho Power Co uses the assembly in conjunction with a plug-in recorder to get charts for secondary voltage surveys.

The meter base is equipped with a 4-ft conduit. A weatherproof twistlock connector at the conduit head is permanently wired to the socket terminals. The installer fastens the meter base to the pole with the chain hamstring clamp, and secures the top of the conduit to the pole with 1¼-in. conduit strap and form nails.

A two-conductor rubber-covered cord is used to connect the secondary that is to be measured to the assembly. Alligator clamps on one end of the cord have pins to prevent accidental disconnection from secondary conductors. Four years' experience indicates that one man can remove or install over a dozen sockets daily.

METER is quickly clamped to pole with hamstring clamp on back of socket



Takes 1.4 Min to Test Meter

Meter test procedure, as further automated by Consumer Power Co, achieves faster rate and one-tester operation in shop

LIGHT SOURCES and photoelectric cells mounted on periphery of test standard can be adjusted to produce control signals in accordance with desired meter accuracy

A. W. RAUTH, General Meter & Laboratory Superintendent, Consumers Power Co, Jackson, Mich.

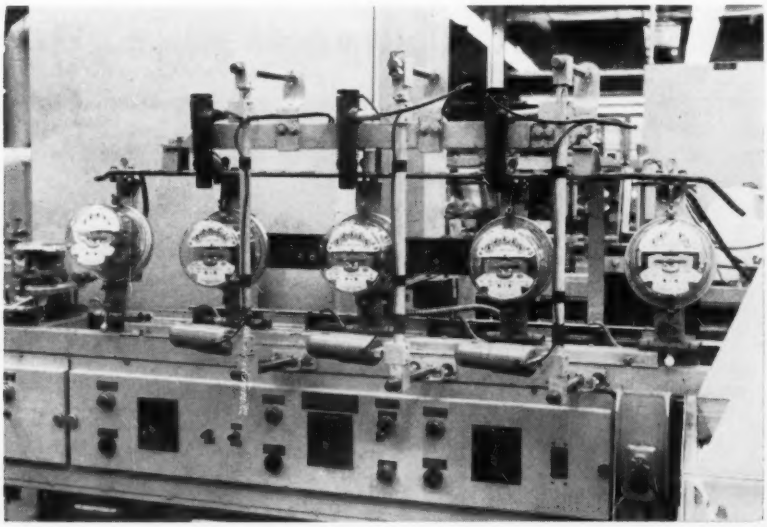
Further automation of Consumer Power Co's meter testing (EW, July 13, 1955, p 86) has resulted in a rate of one meter every 1.4 min and a testing procedure requiring only one operator. Meters, taken from the manufacturer's carton, are placed face up on a conveyor. The procedure begins as the conveyor moves the meters into the test position where even the connections are made automatically. Three meters are tested at a time, full, inductive, and light loads being applied automatically.

Meters meeting the accuracy standard are moved along and are replaced by three new ones. The procedure continues until one of a trio fails. Then a buzzer sounds. The operator marks the meter and pushes a button to start the conveyor again. Tested meters are unloaded automatically on a table where an inspector sends the acceptable ones to the packing table and the marked ones to an adjustment bench.

The "go" and "no-go" signals are obtained from a light beam reflected from a small mirror behind the rotating standard pointer. Two light sources and two photoelectric cells are so placed on the perimeter of the rotating standards that, as the pointer rotates, the mirror reflects light onto a photoelectric cell. On the last revolution of the pointer, the light trips the "go" or "no-go" mechanism.

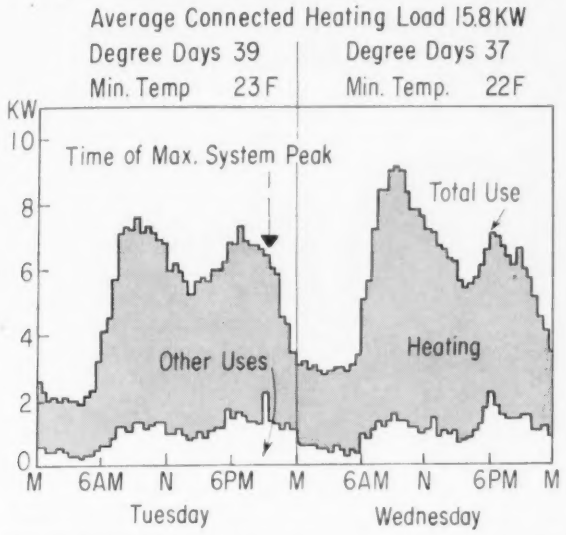
The adjustable cells and light sources are on the periphery of the rotating standard in such a way that when the pointer nears the 100% accuracy limit, the mirror is between the cells. The meter is considered fast when the mirror does not reach the first cell on the last revolution of the standard. The "no-go" signal then flashes, and a horn sounds indicating excessive error. The same signals occur when the pointer passes both cells in a test on a slow meter. When the pointer lies between the two photoelectric cells, meter accuracy is within the prescribed limits, and the "go" signal flashes, moving the tested meters out of the test position and the next group into it.

In tests on 528 meters the conveyor was stopped only five times, once because of a poor electrical connection. The test time of 1.4 min per meter includes taking it from its carton, putting it on the conveyor, testing, and unloading it.



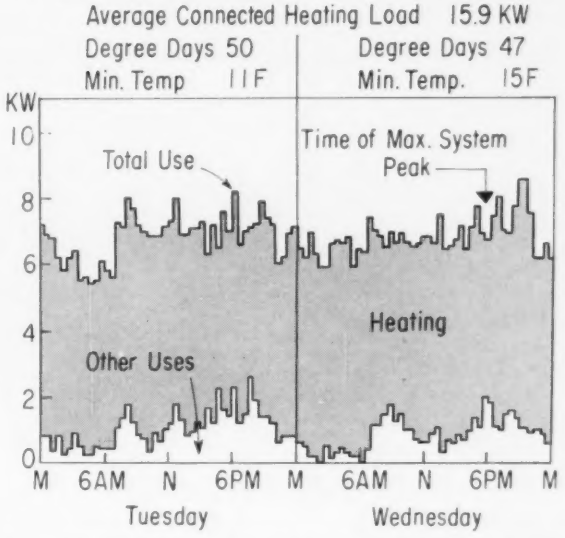
METERS in test position have connections made automatically and move into and out of the position on a conveyor. Method is used for new meters only

Fig.1- Load Curve for Periodic Controlled Operation



NIGHT VALLEY occurs when home using unit heaters with built-in thermostat gives periodic controlled operation

Fig.2- Load Curve: Continuous Controlled Operation



NIGHT VALLEY is eliminated when same type of equipment is on all the time and controlled continuously

Electric Heating Improves Load Factor

Continuous controlled operation with less demand and better load factor is recommended. Customer benefits with more comfortable surroundings, yet cost remains the same

S. L. **FORSYTH**, Sales Manager, Electric Heating, Westinghouse Electric Corp, Staunton, Va.

Electric heating is a very important factor in the Total-Electric Home. Great progress has already been made but it is only the beginning.

The National Electrical Manufacturers Association reports that 1.1 million kw of electric heating equipment was sold in 1956 by manufacturers. They see electric heating growing at the rate of 25% per year for the next five years, then at a slightly less rate until it reaches a total of 10.2 million by 1970.

Consumption-wise, NEMA reports that 4.2 billion kwhrs were used in heating homes entirely by electricity during 1956. By 1960, they estimate 11.9 billion kwhrs will be used; by 1970, 77.6 billion.

The electric heating load curve for a single house depends upon several factors. The living habits of the people is by far the greatest, although weather and type of equipment used plays a major part. Fig 1 shows the one-half hour demand of a single house created by electric heating using unit heaters with built-in thermostat—"periodic controlled operation."

Under these conditions the 15.8 kw of connected heating load created a maximum demand of only 9.1 kw at about 9:00 a.m.—indicating a diversity of demand. Note the definite night valley.

Controlled Operation Used

Fig 2 curve shows what happens when the same type of equipment is on all the time and controlled continuously by thermostats. The maximum demand has shifted to evening and dropped to 8.5 kw, increasing diversity. No large valleys exist.

Comparing the two load curves one can see that the benefits of continuous controlled operations are: Less demand, better load factor. The customer benefits with more comfortable surroundings and, according to most tests, there is no greater cost.

During long cold spells this is the type load curve to expect because people tend to leave their heating equipment on all the time.

Therefore, a utility's program should encourage its customers to use continuous controlled operation at all times.

Because periodic controlled operation creates the worst conditions, let's explore it further. Figs 3 and 4 were developed from the installation of a graphic demand meter installed on the primary side of a 37½-kva transformer serving seven homes. All of the homes had heating. Estimated connected load was:

Cooking, water heating, etc.	**180 kw**
Electric heating	**120 kw**
Total load	**300 kw**

Separate demand meters were installed at each residence. Fig 3 shows the results. The maximum heating demand totaled only 46½ kw—a little less than 39% of connected heating loads, again showing that diversity does exist. Notice that the load factor was 41%.

In Fig 4 the upper load curve shows the total ½-hr demand created at the transformer by all

Fig. 3-Load Curve: Electric Heating

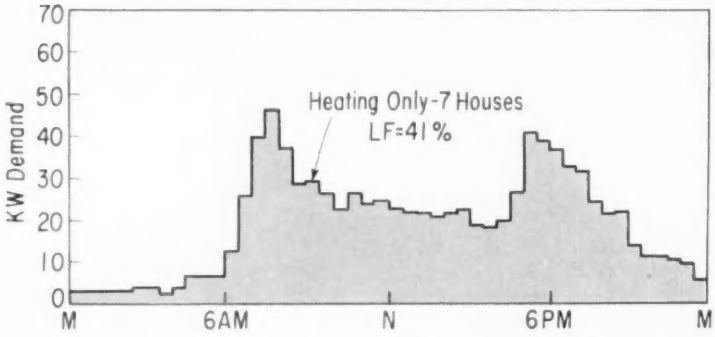
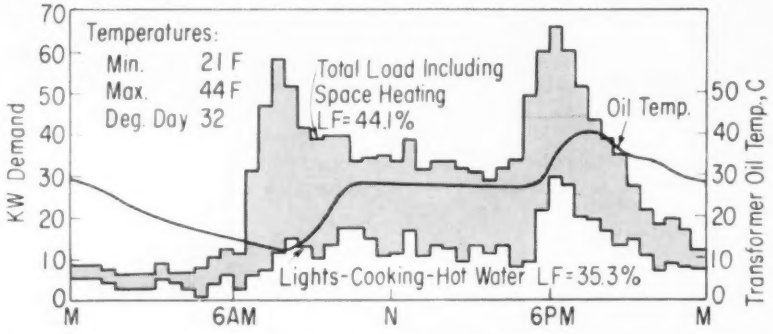
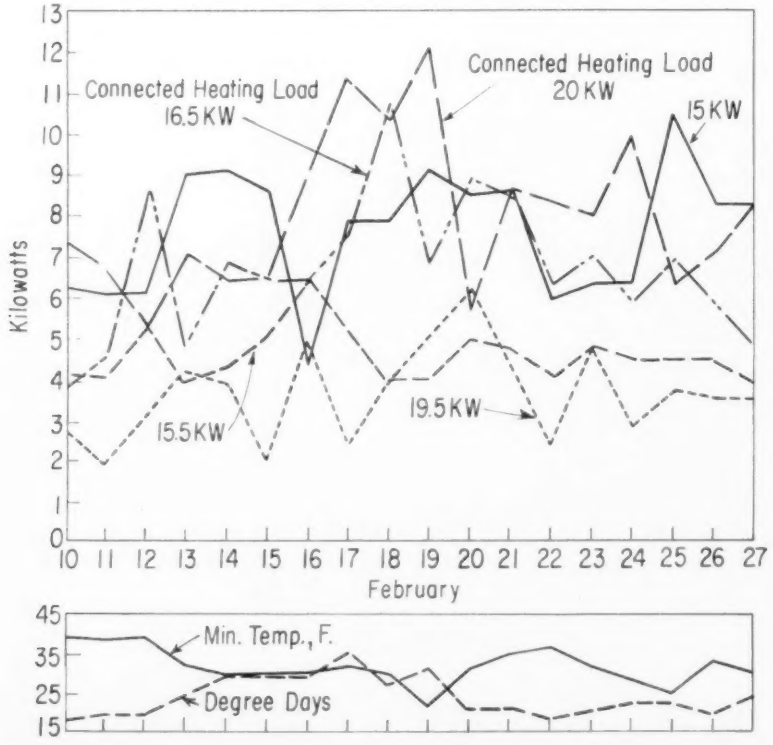


Fig. 4-Load Curve and Transformer Temperature



INCREASED LOAD factor usually results when electric heating is considered part of total residential load. In this case, a little more than 16%

Fig. 5-Daily 30-Min Max. Demands for 5 Electrically Heated Homes



FIVE HOMES with electric heating capacities of 15 to 20 kw have diversity of demand in each house as well, showing living habits have an effect as in the group

the loads, including electric heating. Here the maximum demand has shifted to the evening and increased to 66 kw. It is still only 55% of the connected electric heating load and only 22% of the estimated total connected load. The load factor has increased 44.1%.

The lower load curve was developed by subtracting the simultaneous demand of the seven electric heating installations from the total demand at the transformer. It shows the simultaneous demands at the transformer from lighting, cooking, water heating and miscellaneous service.

Increased Load Factor

The maximum demand of 29.6 kw occuring in the evening probably was due to water heating and cooking. These loads alone had a load factor of only 35.3%. In this case, integrating all the loads including electric heating increased the load factor a little more than 16%. An increased load factor usually results when electric heating is considered an integral part of the ever-growing total residential load.

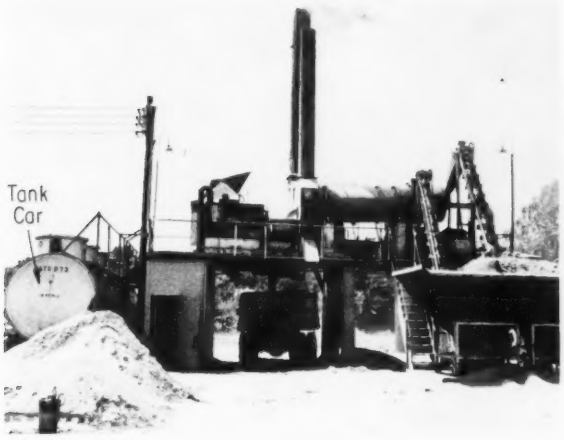
Incidentally, 66 kw is quite a load for a 37½-kva transformer and as you can see the overload lasted over quite a period of hours, yet excessive overheating did not occur. The transformer temperature recorded from a thermocouple immersed in the oil remained within normal limits. The top oil temperature was only 40C and occurred after the peak demand. At the time the ambient temperature was undoubtedly above the daily average temperature which would mean there was even a greater factor of safety.

This is not a recommendation to overload transformers, but it is a recommendation that proper analysis of loads be made and that systems be designed to serve total loads with the most economical system.

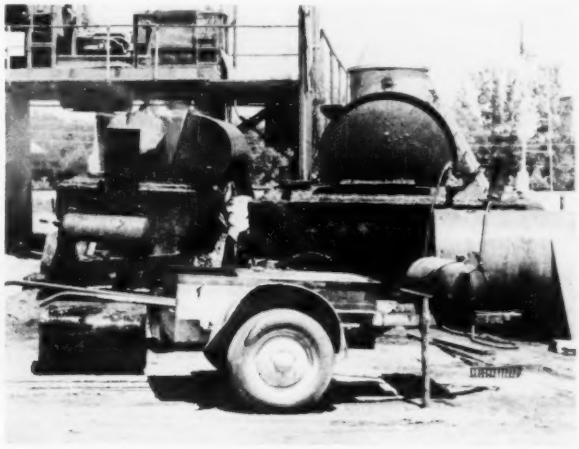
In order to obtain a true picture of the diversity of demand on a group of homes one electric utility selected five homes having installed electric heating capacities of 15 to 20 kw. Accurate records of daily 30-min maximum demands were kept for a period of one month. Fig 5 shows the interesting and, at first, confusing result.

On the coldest day, the 19th,

(*Continued on page* 69)



NOW asphalt is delivered in liquid form, stored in converted wine tankcar. Special heaters keep car at 275 F to 300 F.



FORMERLY asphalt was bought in drums and dumped into oil-fired boiler to melt. Splashing created safety hazard.

Novel System Boosts Plant Safety, Efficiency

Specially designed heaters convert damaged wine car to efficient asphalt storage tank.

EARL PALMBERG, Electric Heating Specialist, Kansas Power & Light Co., Topeka, Kansas.

Ingenuity, engineering skill, and cooperation between an asphalt plant owner and utility power sales people have produced a more efficient operation and eliminated a safety hazard at the Topeka Asphalt Co., Topeka, Kansas.

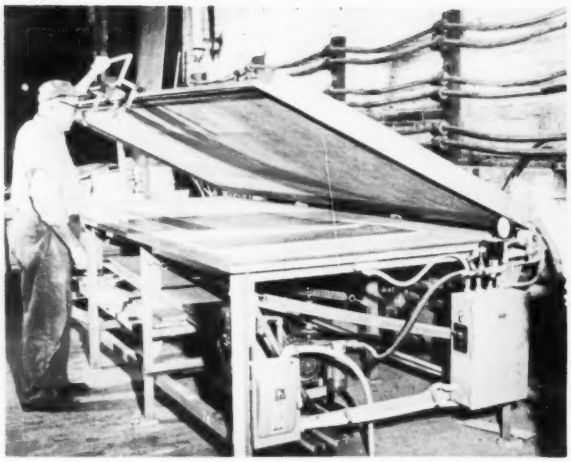
Dissatisfied with an existing, oil-fired method of heating asphalt, the asphalt plant owner hit upon the idea of using a damaged but well-insulated wine tankcar—if it could be heated electrically. Since the car could not be heated from the bottom in the manner used in conventional, electrically heated asphalt tanks, Kansas Power & Light Co. engineers designed heaters that could be inserted through the manholes in the top and lowered to the bottom of the tank.

Each of the six compartments in the car has a 12-kw heater which raised the asphalt from 275 F to 300 F. A low heat intensity prevents coating or burning the asphalt. Asphalt is brought to the plant in a liquid state by a transport and electrically pumped into the storage tank car.

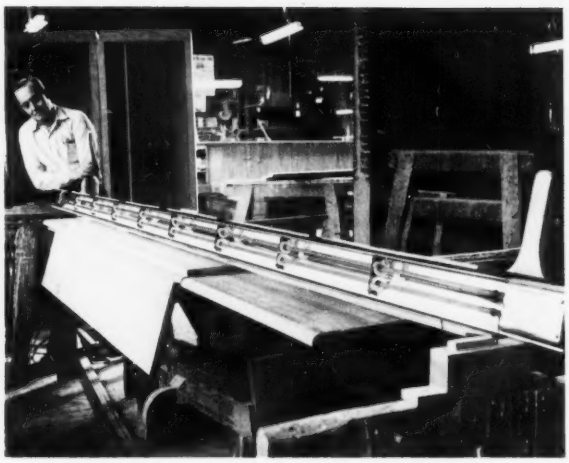
It is then pumped into a reheat vat, where a 12-kw heater brings the asphalt up to approximately 325 F before it is mixed with the sand and gravel. Over 300 ft of electric heating cable, rated 10 watts per ft, is wrapped around the interconnecting plumbing and piping to keep the asphalt hot as it goes through the various stages.

Before the new system was installed, asphalt was purchased in drums in a solid state. To get the asphalt out, the drum was thrown into an open boiler by a tractor. When the drum landed, the hot asphalt already in the boiler would splatter, creating a safety hazard and a messy working area.

SPECIAL 12-KW HEATERS were designed to fit into the round openings on the car top and then lowered to the bottom



Gluing plastic to wooden bases . . .



and bending laminated plastic . . .

Electric Heat Speeds Output, Reduces Rejects

W. F. HUTCHINS, Industrial Sales Engineer, West Penn Power Co., Ridgway, Pa.

Using electric heat to bend and glue laminated plastic for kitchen and counter tops is paying off in faster production and fewer rejects at the Hyde-Murphy Co. in Ridgway, Pa. The task of gluing the plastic tops to a wooden base is handled in six to eight minutes by an 11-kw electrically heated press.

With manual gluing, the job took hours. In addition, the plastic would often blister and the entire job would have to be done over. With electric heat, the job is done right the first time. The bonding is done at 175 F. Heating elements are woven into the screen on the lid of the press.

In another operation, a 10-ft 11-kw radiant strip heater is used to bend the laminated plastic safely, accurately, and efficiently. Heat is applied in exact quantities, right where it is needed. Temperature does not fluctuate.

The plastic is bent in two or three minutes. And the bend is strong. This process eliminated butt corners on work counter tops and enables the company to turn out kitchen units faster.

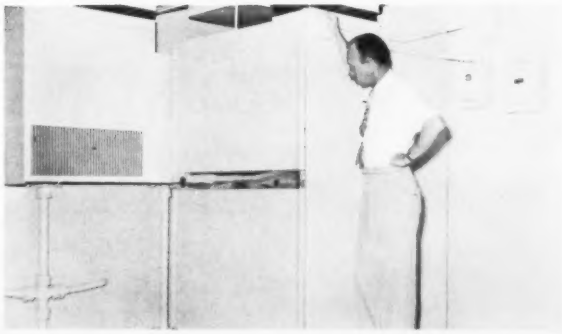
First step in forming the bend is to apply blue paint along the line of the bend. The radiant heater then brings the material up to 325 F. A change in the paint color determines the end of the heating cycle.

Using these and other forms of electric heat have enabled Hyde-Murphy to produce one-third more in the same time without increasing their staff.

Experience Proves Heat Pumps Are Economic

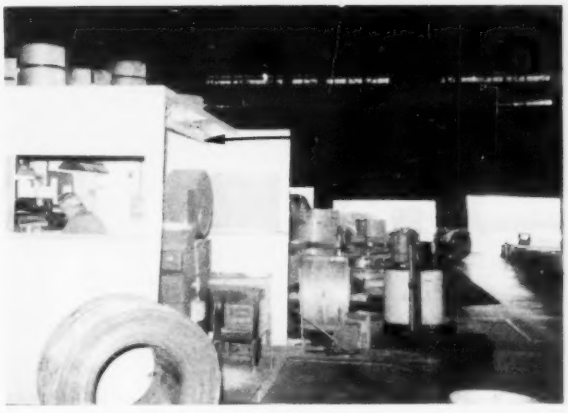
GEORGE C. WAGNER, Industrial Sales Engineer, Union Electric Co., St. Louis, Mo.

Cleanliness and automatic year round air conditioning are the "extra" benefits of a modern heat pump installation in the St. Louis terminal of the Interstate Motor Freight System. More important, eight months of operation have proven that both initial cost and cost of operation of the two 5-ton units are competitive with that of the fuel-fired furnace and mechanical air conditioning system originally planned for the 6,000 sq ft of office and locker space.



Infra-Red Keeps Weigh Station Comfortable

B. M. LYONS, Industrial Sales Engineer, Cleveland Electric Illuminating Co., Cleveland, Ohio.



A simple electric heating installation effectively solved the problem of heating a specific area in a large, uninsulated shipping building at a U.S. Steel Co. plant near Cleveland. Installed in a building approximately 1,000 x 200 x 50 ft high at the American Steel and Wire Division's Cuyahoga Works, the electric heater keeps the weighing and recording station comfortably heated, despite the fact that doors at both ends of the building are open most of the time.

To provide maximum heat distribution, the 4-ft, 5-kw infra-red heater is mounted seven ft above the floor. An input controller maintains the desired heat level; the shipping clerk can now choose the amount of heat he needs to suit the weather conditions.

Because loading operations go on night and day, the large, garage-type doors on the corrugated steel building are open a majority of the time. On one end of the building, the doors face directly into the prevailing winds. Under these conditions, it would be very difficult to heat a specific area in such a building with conventional heating systems.

Novel Heating System Has Multiple Functions

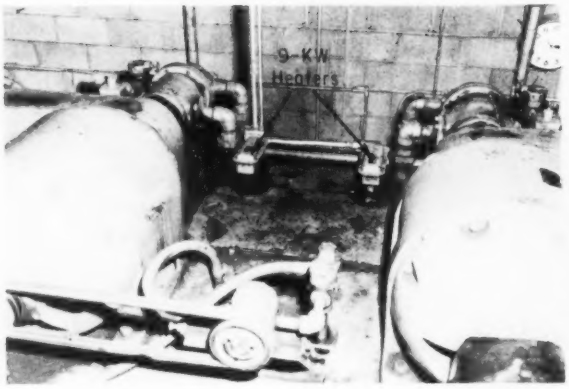
An electrically heated hot oil system that serves both a pavement stockpile area and process equipment is a novel feature of the Highway Construction Service Co.'s asphalt plant in Lombard, Ill. Hot oil flowing through a network of one-inch pipes set in concrete keeps the truck approach area ice-free in winter and facilitates handling of the stockpiled material. The network area is laid out in five sections which may be heated individually.

The two 84-kw multi-pass electric heaters, each containing seven elements, are equipped for three stage operation to assure economical use of power. Electric heating was selected for safety and ease of control.

Each heater is equipped with a 5-hp 35-gpm pump to circulate the oil. The circulating oil is also used to heat tank cars for unloading and to heat the storage tank for pumping to the mixing plant. Thermostats can be set to heat or maintain asphalt at any temperature from 75 to 600 F, making it adequate for either hot mix or cold mix operation.

What's Your Production Problem?

If you have problems in lighting, drying, casting, forging, painting, or materials handling, consult your local power company. Let their experienced specialists show you how to cut costs with electric power.



Immersed in oil reservoir . . .

for hydraulic ram . . .

Heaters Keep Baler Working Through Winter

GLEN J. ALDEN, Industrial Sales Engineer, Minnesota Power & Light Co., Duluth, Minn.

Trouble-free operation of a hydraulic scrap iron baler, right through the cold Minnesota winter—two 9-kw immersion heaters did the job easily at the West End Iron & Metal Co. in Duluth. Installed in a 600-gal reservoir of hydraulic oil, they keep the fluid from congealing even when the temperature drops to –30 or –40 F.

Oil is drawn from the reservoir by two 75-hp, 480-v, 3-phase motors which power rams capable of compressing a hopper full of scrap iron from 1,000 to 9 cu ft. The two 480-v, 3-phase heaters are thermostatically controlled to hold the oil in the reservoir at 55 F.

The reservoir and the controls for the ram are housed in an uninsulated concrete block building. Before the heaters were installed, the hydraulic oil congealed in cold weather and prevented operation of the baler. When the company attempted to operate the baler, the 75-hp motors would overload and trip the breakers. Hydraulic lines and valves were also damaged.

To remedy this, West End planned to install oil burning space heaters in the building. However, the immersion units heat only the reservoir, which is all that is required, and are therefore more economical than attempting to heat the entire, uninsulated building. They have now been in operation for over a year. They require no maintenance or labor to make heat available. The baler is now ready for use at any time, winter or summer.

Heaters Eliminate Waste Bread, Cut Costs

JOSEPH McCLELLAND, Industrial Engineer, Gulf States Utilities Co., Beaumont, Texas.

Electric heaters installed in the delivery trucks owned by Rainbo Baking Co., Beaumont, Tex., improve efficiency and assure that bread is delivered fresh. The heaters, rated at 220 v and 1,500 w, are installed in more than 45 delivery trucks. At night the trucks are "plugged in" and turned into bread warming ovens to keep the bread fresh and ready for delivery the next day. Automatic controls maintain the temperature at 85 F.

By use of this heat, Rainbo is able to increase efficiency as well as hold down costs by rescheduling shifts, eliminating waste bread, and reducing pre-delivery loading time.

Collins Microwave System Installed for Tampa Electric

A 5-station microwave system, built and installed by Collins Radio Co, Cedar Rapids, Iowa, for Tampa Electric Co ties in all the utility's operations centers, business offices and mobile radio fleet. Control of substations is provided. Shown is main dispatching office, with microwave tower. Presently set up for 17 channels, plus fault alarm and service channels, the operational fixed, hot standby installation is expandable to 120 channels.

Each station has 115-v ac primary power source, with auxiliary standby power generator made by D. W. Onan Co, Minneapolis. Receivers operating in the 6000-mc band supply a wideband baseband signal output for carrier equipment. Transmitters generate a microwave RF signal carrier in the 6000-mc range, frequency modulated with a nominal carrier deviation of plus or minus 3 mc. Supervisory control and telemetering equipment was supplied by Control Corp of Minneapolis.

GE Realigns Prices on Three Transformers

A price realignment on three types of transformers was put into effect by General Electric Co, Pittsfield, Mass., on February 1. Products involved are mobile transformers and mobile substations; oil-immersed, current-limiting reactors; and furnace transformers—all for special applications.

New prices involve increases of from 5% to 10% in some ratings. According to the company, they will more accurately reflect cost relations which have been changing steadily since the present prices went into effect a few years ago.

Electric utilities are chief users of mobile transformers and oil-immersed reactors. The steel, ferroalloy and chemical industries use furnace transformers more than other industries.

FPE Gets $1-Million Philippine Contract

Contract between Federal Pacific Electric Co, Newark, N. J., and National Power Corp of the Philippines covers $1 million worth of high-voltage electrical equipment. It will be used to increase capacity of the Balintawak substation in Manila and to prepare it to receive power over a new 220-kv line.

Apparatus includes 13 oil circuit breakers for 14.4 to 230-kv, transformers, disconnect switches, and steel switchyard structures.

Foresee Cold-Cathode Tube Uses in Control and Radio

A cold-cathode vacuum tube discovered in the U. S. Signal Corps Laboratories is being developed by Tung-Sol Electric Co, Newark, N. J. This tube has no heater, emits a blue light, and has a cathode consisting of a thin layer of magnesium oxide deposited on a nickel sleeve.

Present design requires 300 v for starting, starts immediately, consumes 0.7 w, and can idle on 5 millionth of a watt. Restarting is in about 0.001 sec. New tube is comparable but does not replace radio tube 6AQ5. Cost and noise level are about same as hot-cathode tube.

Foreseeable applications are: Electric computers, garage doors, automation controls, radios, telephone cables and walkie-talkies.

Further developments are in progress and tubes will be available in about a year.

Bushings Welded to Tanks

Low-voltage bushings made of alumina, capable of being welded to network transformers, have been introduced by General Electric Co. Advantages specified: shorter and stronger than porcelain or glass, welded to the tank, dielectric strength is about 10% greater than porcelain, lower transformer throat.

Dynalab in Ohio Ed Service

The Dynalab, a mobile vibration laboratory developed by Preformed Line Products Co, Cleveland, (EW, Oct. 13, 1958, p 86), is currently in service recording vibration on Ohio Edison Co's new 345-kv transmission line. A paper on the construction and application of this trailer laboratory will be presented by PLP's Jon R. Ruhlman, vp-research and engineering, at the AIEE Winter Meeting Feb. 1-6 in New York.

Before you buy another tr

transformer... COMPARE FEATURES

General Electric–alone–offers <u>all</u> these exclusives which add up to reliability, long life, less maintenance for you

General Electric innovates to earn your orders. So compare these features with competitive features to determine your best transformer buy.

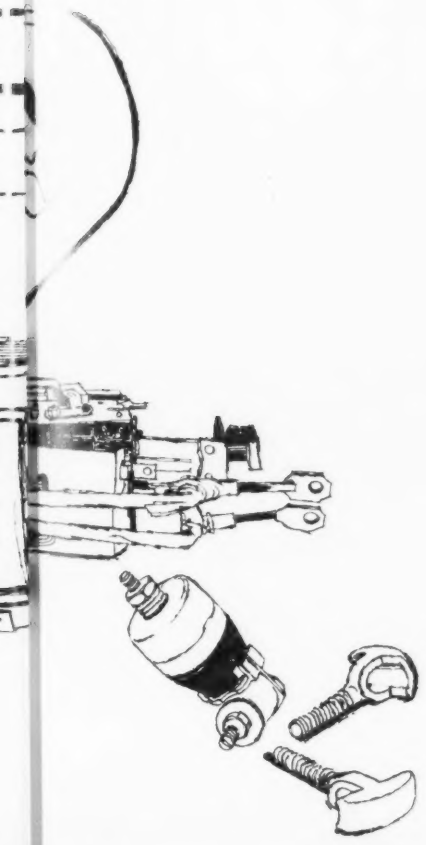
Be sure to compare *all* features. You'll see that only General Electric offers *all* these exclusives: Formex* wire; AL CU terminals; strenicor clamps; stainless-steel bands and nitrile rubber gaskets; valve-type arresters—so that the sum of individual features adds up to greater value in long, reliable life.

Before you buy another distribution transformer, compare features—give your transformer manufacturer credit for the extra values he gives you. General Electric Co., Schenectady 5, N. Y. 431-81

* Reg. trademark of G.E. Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC

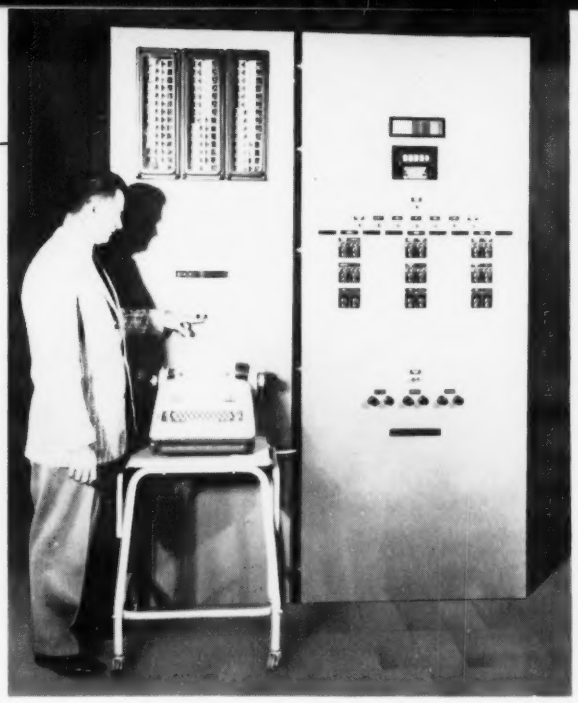


GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU		G.E.	OTHER MFRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

New Equipment

(For further information refer to Reader Service on page 58)



Data Logging System . . .

. . . is designed for all applications where centralized data transmitting and logging systems are required. Called APRIL (Automatically Programmed Remote Indication Logging), the system converts analog-type quantities to a binary code form and transmits the information from a remote location. It can be incorporated as part of a new supervisory system or added to existing General Electric equipment.
General Electric Co, Schenectady 5, N. Y.

Tapeless Connector . . .

. . . . for underground distribution systems joins as many as eight cables where water-tightness must be insured. The Dossert Micon consists of an insulated rubber or neoprene sleeve, two clamping bands and a body element for each outlet. Conductor sizes from No. 8 stranded through 250 MCM are handled by one connector size; 1/0 through 500 MCM by another. Basic types MZH, for end outlets; MZL, for side outlets; and MZC, a tapeless crab, are available.
Dossert Mfg Corp, 249 Huron St, Brooklyn, N. Y.

Current Transformer . . .

. . . has 400/800 amp dual range to provide extended capacity for future growth after initial installation on the 400 amp range. By using one or more primary turns the transformer can be used on loads ranging from 20 to 1,600 amp. It is an addition to the company's line of Type BH-6 color-coded transformers, and has the same physical characteristics and features.
Sangamo Electric Co, Springfield, Ill.

(*More New Equipment on page* 58)

Many tests are made to compare various conduits under different exposure conditions. One of the most severe is the sulfuric acid test. Immerged into a 7½% solution of sulfuric acid, the zinc protection on ordinary brands of conduit fails in less than 6 hours, while the MVC-1 coating on SHERARDUCT stands up for 72 hours and longer. Other accelerated tests—salt spray, caustic soda, etc.—do not affect the MVC-1 polyvinyl coating.

HOT ZINC COATED
SHERARDUCT with MVC-1
provides permanent protection of electrical wiring

Even under the most severe service conditions, hot zinc coated SHERARDUCT with MVC-1 gives lifetime protection of wiring. MVC-1—the baked-on polyvinyl chloride resin coating—is an exclusive National Electric development. It resists all types of corrosion. On top of the hot zinc coating of SHERARDUCT, MVC-1 adds years to the service life of your conduit system . . . even in extreme service exposure conditions.

In addition to its exceptionally high corrosion resistant properties, MVC-1 is exceptionally resistant to abrasion, and it is not adversely affected by high or low temperatures. Once installed, hot zinc coated SHERARDUCT with MVC-1 is there to stay.

SHERARDUCT also gives you time-saving and money-saving benefits on the job. The slow heating-cooling "normalizing" process gives SHERARDUCT easy-to-bend properties, easy to cut and re-thread in the field—no cracking, no flaking of the finish. Besides, the smooth inside surface of the polyvinyl coating makes fishing easier and faster . . . provides protection against corrosion for the interior of SHERARDUCT.

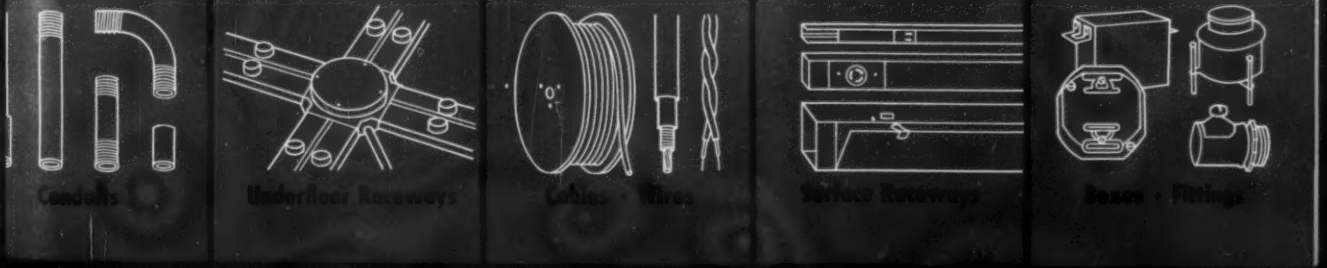
Added together, these benefits mean hot zinc coated SHERARDUCT with MVC-1 provides top money value . . . in ease of installation . . . in years of protection. Why take less, when with SHERARDUCT you get the best. VMA-6303

National Electric Products Corp.

In Canada: NEPCO of Canada, Ltd.
PITTSBURGH 22, PENNSYLVANIA

SALES OFFICES LISTED UNDER
Bennett Associates, Inc.
Sales Offices and Warehouses in Principal Cities

The NEPCO quality family provides dependable, permanent, maintenance-free electrical systems



Why Uptegraff TRANSFORMERS withstand exceptional service stresses

Balanced insulation design is the reason.

The benefits of Uptegraff's "balanced" insulation design are—a high level of transformer performance and longer service life . . . through capacity beyond its normal rating to withstand transient overvoltage conditions.

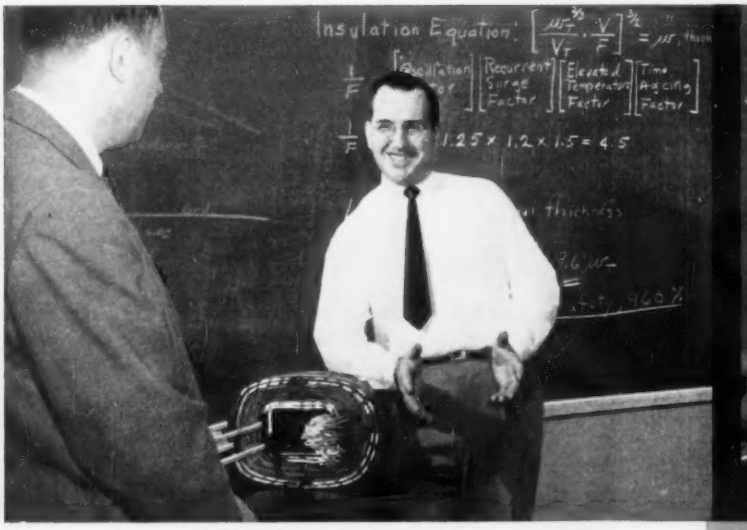
Uptegraff achieves this "balanced" insulation design by research, experimentation and testing. This means that our engineers are collecting data of various types of actual field service conditions, appraising this data relative to insulation stresses, and persistently searching and analyzing new and better insulation materials and fabrication methods.

But that's not all. Strict quality-control in the actual fabrication of coil windings and thorough testing of sub-assemblies and of the finished product are also important. The result is transformers with an extra margin of safety—making allowances for recurrent overvoltages, high temperatures, aging, conductor shape factors and other considerations.

Write, today, for descriptive literature on any of Uptegraff's major types of transformers . . . Power, Distribution, Lighting, Load Center, Network, Instrument, Specialty. Types and sizes for all classes of service . . . up to 10,000 kva.

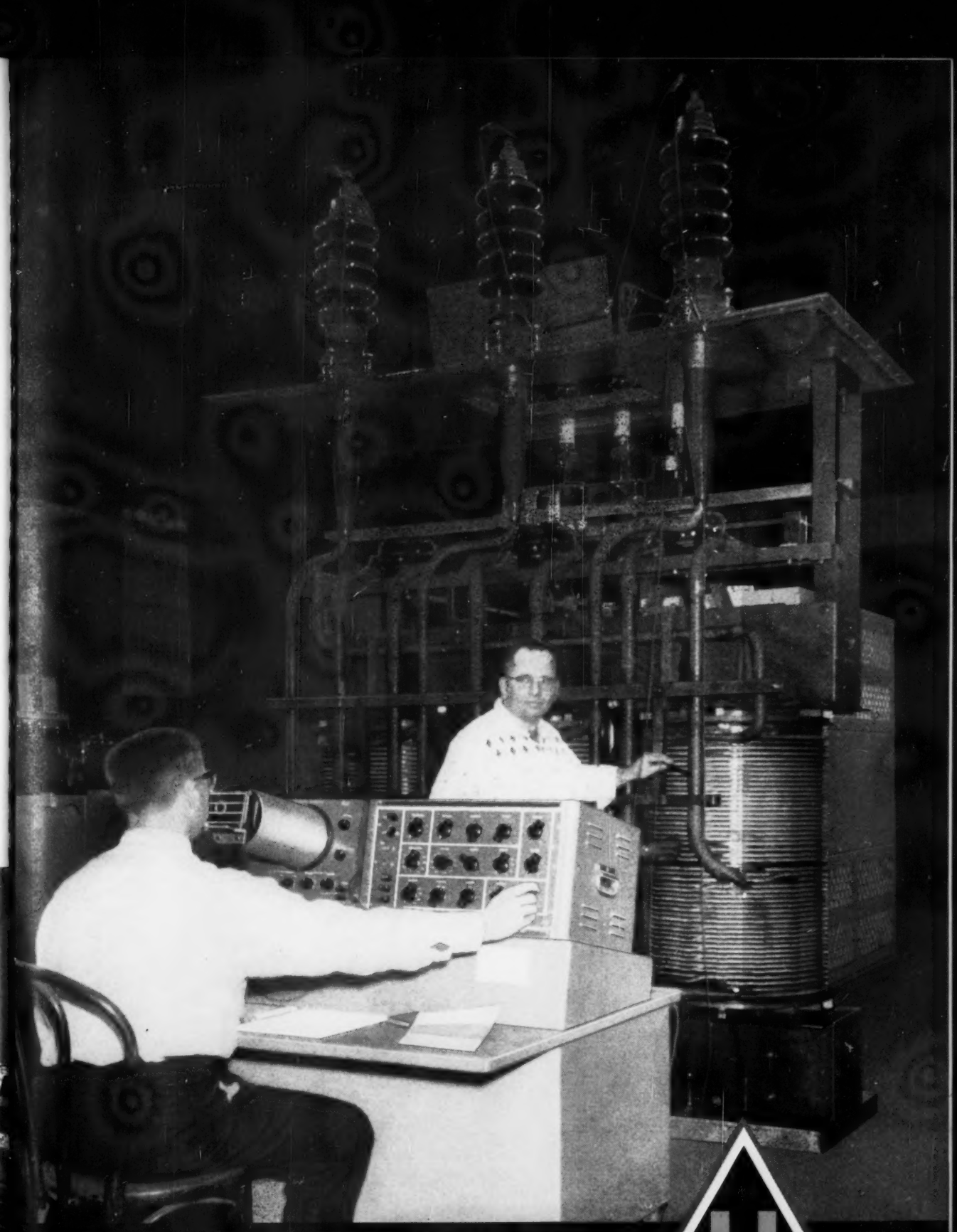
R. E. UPTEGRAFF MANUFACTURING COMPANY

SCOTTDALE, PENNSYLVANIA



Uptegraff's unrelenting objective is to design insulation which meets specific service requirements and assures maximum insulation utilization.

Coil winding of Uptegraff transformers is carefully supervised by craftsmen who have 20, 25, and 30 years of experience in transformer building.



Uptegraff's superior transformer performance in actual field service is assured by obtaining an understanding of the voltage distribution in the windings under transient conditions. Here a transient analyzer is being used to study the transient voltages in the windings of a 3750 kva transformer.

Reader Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

GE ..... Data System ☐
Dossert ..... Connector ☐
Sangamo ..... Transformer ☐
Arps ..... Trencher ☐
Holan ..... Ladder ☐
Bussman ..... Fuse Blocks ☐
L-M ..... Wireholder ☐

MANUFACTURERS LITERATURE

Code No. .....

(Requests are made from code numbers on page 78).

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

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TITLE_____
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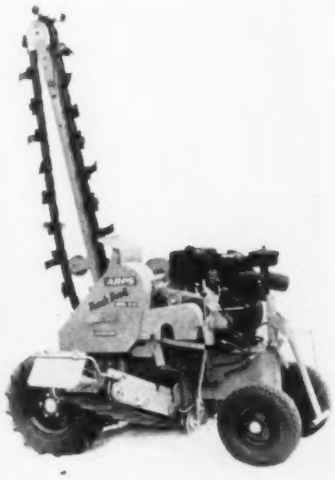
ADDRESS_____

FOR:

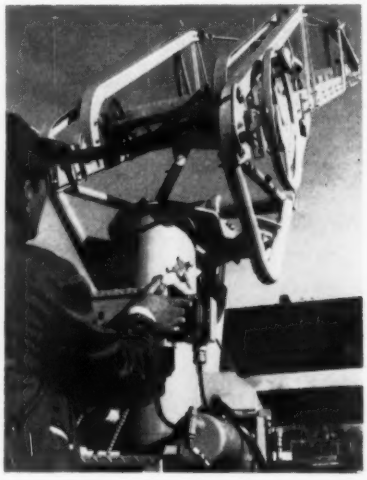
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

FEBRUARY 2, 1959



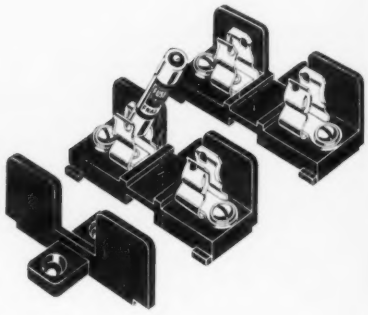
One-Man Trencher . . .

. . . has digging speeds variable from 0 to 1,200 ft per hr in either direction. The Model M-A Trench Devil may be transported for short distances under its own power at 2¾ mph. For long distance moving, it can be easily skid-loaded on pickup trucks or small trailers. Five digging widths—2¾, 3½, 4, 6 and 8 in., up to 54 in. deep, are available. The hydraulic drive permits instantaneous reversal of direction while digging.
Arps Corp, New Holstein, Wis.



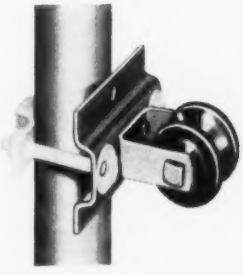
Pushbutton Ladder . . .

. . . operates from control station on the mast. The series 2600 Manually Operated Hydraulic Ladder goes up and down by simply pushing a button. For more precise spotting, there is a globe-type needle valve with a long handle. The operator can accurately lower the ladder by pulling on a lever. Three models are for 24, 28, or 32-ft ground-to-platform heights.
Holan Corp, 4100 W 150th St, Cleveland 35, Ohio.



Fuse Blocks . . .

. . . simplify protection of solenoids or small motors or control apparatus on multiple circuit equipment. The BUSS Add-On blocks may be assembled into a unit fuse block of one or any number of poles. The single pole blocks interlock by means of a boss that slips into a recess in the bottom side of the adjacent block. Each unit is firmly locked in place by a single screw.
Bussman Mfg Div, McGraw-Edison Co, University at Jefferson Sts, St. Louis 7, Mo.



Wireholder . . .

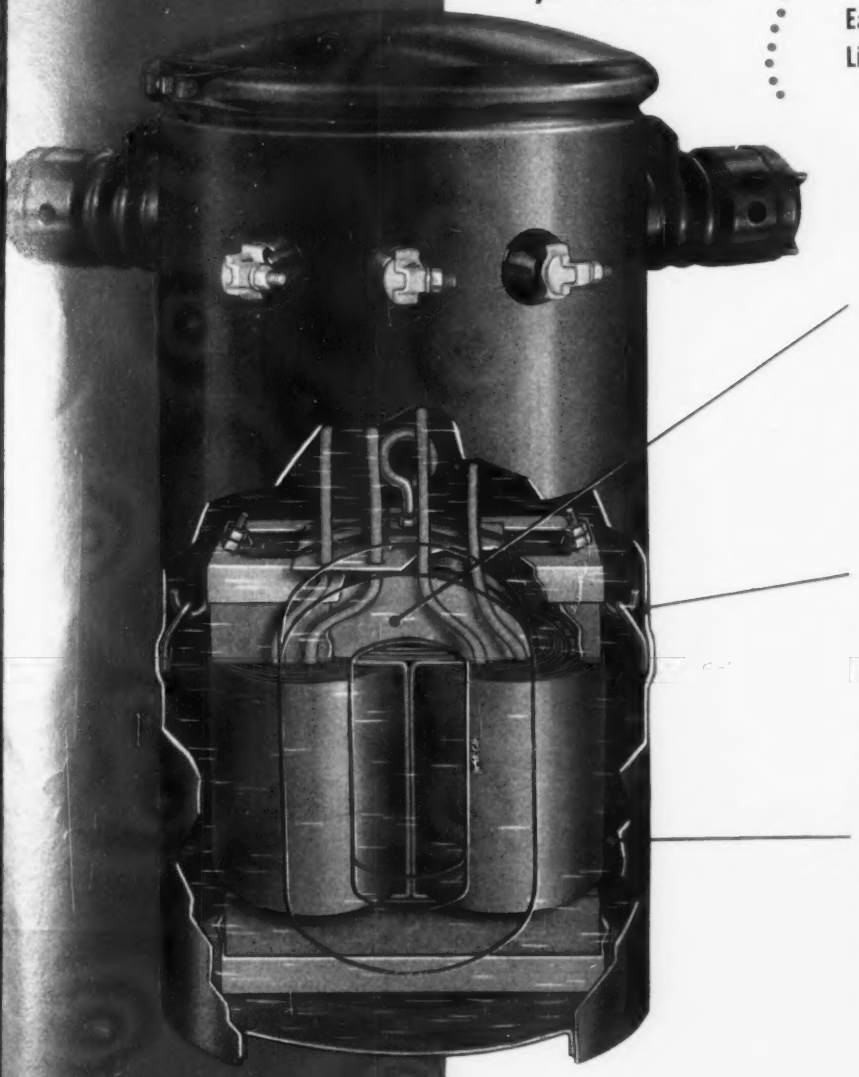
. . . facilitates termination of triplex service drops to low-roofed structures. The single-point, spool-type unit may be mounted on roofs, vertical walls, or pipe masts up to 2½ in. in diameter. The bracket is furnished with a clevis bolt, lock washer and nut.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

RT&E

engineering talent concentrated on transformer CORE development

provides

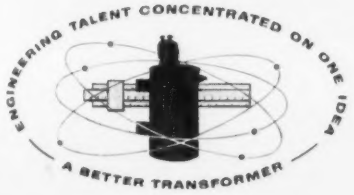
- **Lower Core Loss**
- **Uniform Performance Characteristics**
- **Quieter Operation**
- **Easier Repairability**
- **Lighter Weight**



The R T & E wound core represents the newest innovation in core construction in over 20 years. It is constructed of the finest grain-oriented steel available, formed into a compact core of single turn laminations with butted joints. It has set new standards for lower core losses, quietness of operation, uniformity of performance and easier repairability.

Two "J" bolts fasten the assembly securely to tank wall and exert a downward pull on the upper core clamp. The compressive force produced clamps the full-span coil blocks firmly against the coil sections for added short circuit strength.

The unique R T & E method of fastening the core-coil assembly in the transformer tank eliminates the need for conventional side braces by utilizing the tank wall for this purpose. Elimination of these side braces exposes more coil surface to the oil, and provides an unobstructed path for oil circulation through the coil ventilating ducts.



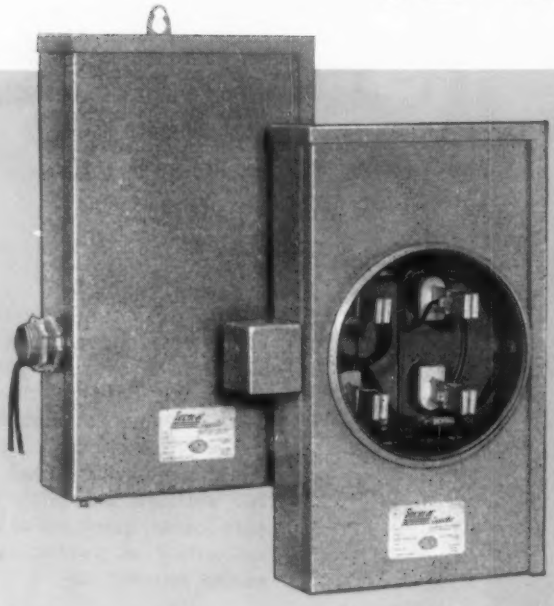
RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

DEVELOPED TO MEET YOUR NEEDS:

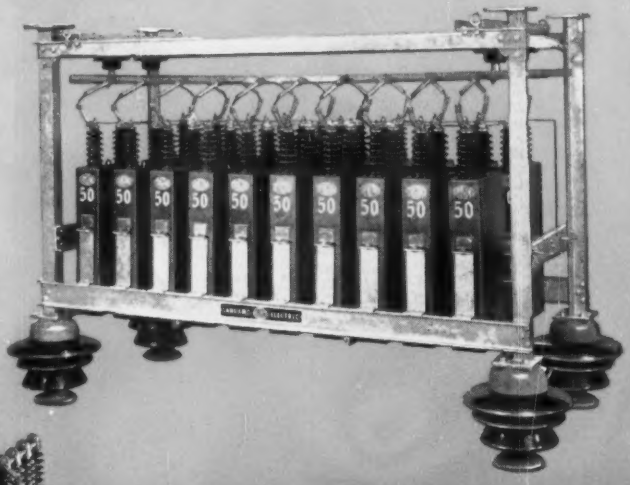
New capacitors,

TO INCREASE THE



SECOVAR
Secondary Capacitors

These 240 volt capacitors are an exclusive Sangamo development. Installed at the customer's service, Secovars give maximum system benefits all down the line—and give the advantages of low first cost, quick and easy installation off the pole.



OPEN-TYPE Equipments

These cost-cutting single-phase or polyphase stacking units have been designed for combinations to give any desired kvar for all primary voltages.

CLUSTER-MOUNT
Autovar Equipments

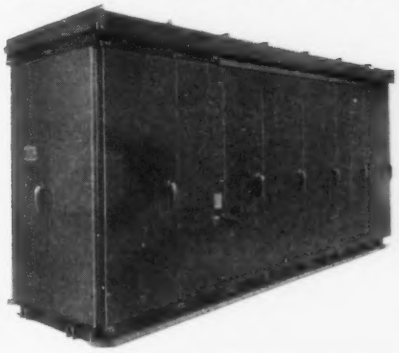
Sangamo engineered, pre-wired cluster-mount equipments give you a fast, easy, economical capacitor installation and better weight distribution on the pole.

NEW CONTROL ADDITIONS TO THE MOST COMPLETE LINE IN THE INDUSTRY

equipments, and controls

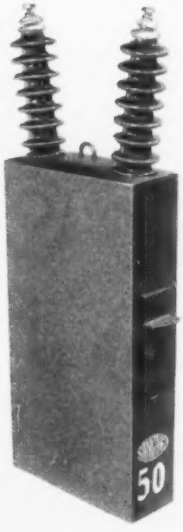
UTILITIES SALEABLE POWER

Keenly aware of your problems of reducing the amount of wattless power and improving voltage on your system, Sangamo's developments this past year make its line of capacitors and controls the most extensive in the industry . . . your first source of supply for all capacitor needs.



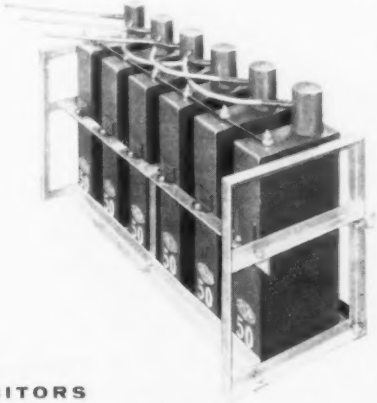
HOUSED CAPACITOR EQUIPMENTS

Combining safety and neat appearance, these housed equipments provide a compact installation with features including automatic control and circuit breakers.



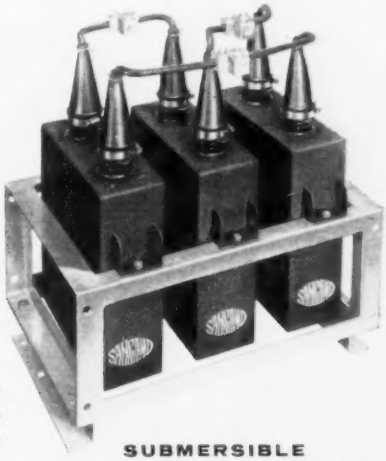
15 KV CAPACITORS

These capacitors were developed for floating Y applications and are capable of resisting voltage surges up to 95 kv.



SUBMERSIBLE PRIMARY EQUIPMENTS

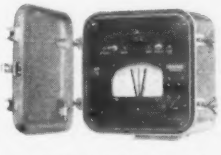
Sangamo designed these completely sealed primary equipments for underground installation in locations where overhead pole space is not available.



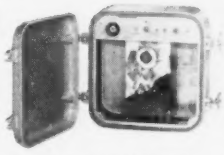
SUBMERSIBLE SECONDARY EQUIPMENTS

Developed for low voltage underground network installations, these factory-assembled equipments are completely submersible.

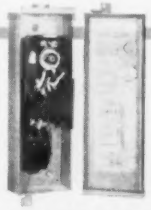
Socket type voltage Lincolntrol



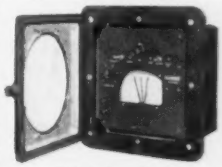
Voltage Lincolntrol with thermostat bias



Carryover socket type time switch



Carryover type time switch



Switchboard type Lincolntrol

To keep pace with your switching applications, Sangamo's new control developments, in addition to the above, are units for temperature control, current bias voltage control and sequence switching.

PC59-1

SANGAMO ELECTRIC COMPANY

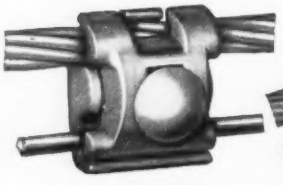
SPRINGFIELD, ILLINOIS

You get Versatility in BLACKBURN'S PermaCad GENERAL PURPOSE Fittings

CHECK THESE PLUS FEATURES

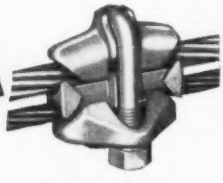
- All fittings may be used on either aluminum or copper conductors. Each fitting accommodates a wide range of wire sizes—few fittings are needed in stock or on trucks.
- Installation errors are eliminated on bi-metallic connections. Either groove will accommodate aluminum or copper conductors.
- Permacad fittings are available in one or two bolt parallel groove clamps—single and double U-bolt clamps. There's a fitting for every job.
- Grooves are contoured to surround conductor and provide large contact areas . . . improving conductivity.
- Non-copper-bearing, heat treated aluminum alloys used in all castings. Hardware available in either hot dipped galvanized steel or high strength aluminum alloy. Bolts alumilited to prevent seizing.

* **PERMACAD** *is a complex, heavy duty plating of cadmium and other metals which has exceptionally long life. PERMACAD protects aluminum because of its favorable electrogalvanic potential and is highly resistant to galvanic corrosion when in contact with copper.*

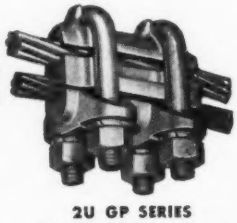


PGP SERIES
One bolt parallel groove clamp. Three fittings accommodate wire ranges from 8 AWG to 397.5 MCM.

PGP 400 SERIES
Two bolt parallel groove clamp. One clamp accommodates conductors from 1 str to 400 MCM.



DLC GP SERIES
Single U-bolt clamp. Four clamps accommodate wire range from 6 AWG to 266.8 MCM.



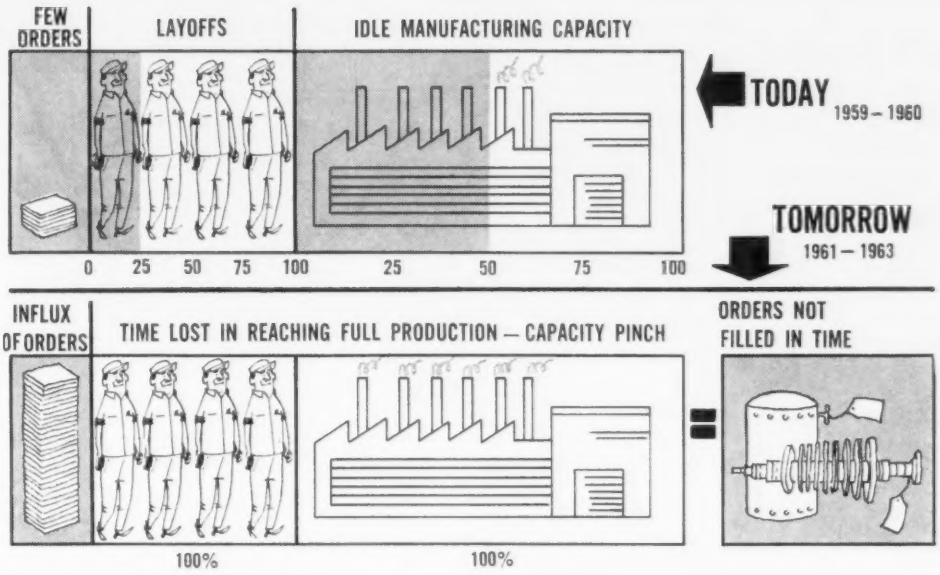
2U GP SERIES
Double U-bolt clamp. Six clamps accommodate conductors from 1 str to 397.5 MCM.

BLACKBURN PermaCad FITTINGS

IMPORTANT: We recommend the use of CONTAX on all aluminum and bi-metallic connections. CONTAX is an oxide inhibiting compound with an ASTM drop point in excess of 500° F.

AVAILABLE THROUGH ELECTRICAL DISTRIBUTORS EVERYWHERE

JASPER BLACKBURN CORPORATION
1525 WOODSON RD., ST. LOUIS 14, MO.
WYdown 3-9430


FEW ORDERS
LAYOFFS
IDLE MANUFACTURING CAPACITY
TODAY 1959 – 1960
TOMORROW 1961 – 1963
0 25 50 75 100 25 50 75 100
INFLUX OF ORDERS
TIME LOST IN REACHING FULL PRODUCTION – CAPACITY PINCH
ORDERS NOT FILLED IN TIME
100% 100%

Boiler and turbine manufacturers warn utilities . . .

Order Now or Risk Late Delivery

Report on **Heavy Equipment**

Unless electric utilities order in early 1959 the boilers and turbines needed in 1962 and 1963, they face the stark prospect of not receiving this generating equipment when they need it.

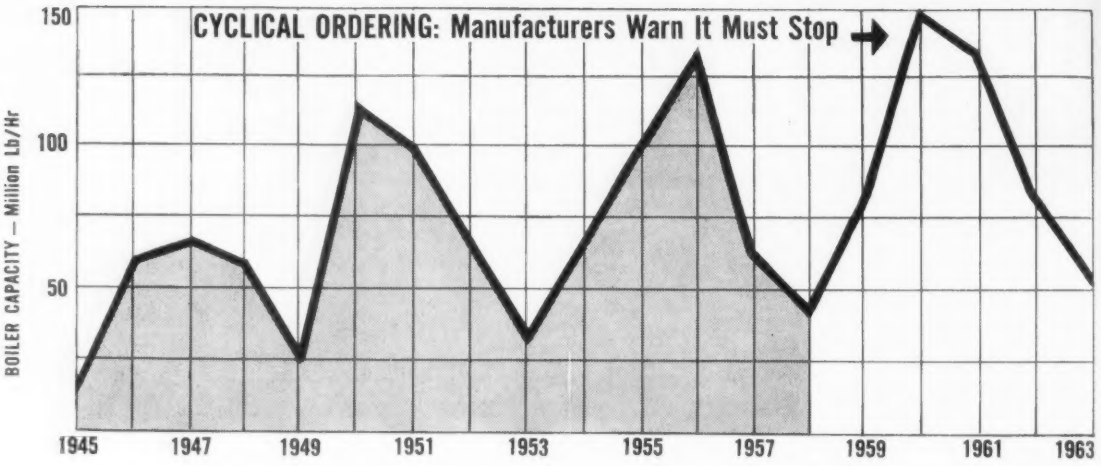
Several boiler and turbine manufacturers are seriously alarmed by the situation. Their causes for alarm vary somewhat, but the end result is the same—it now appears that utility customers may have passed the point of no return. Unless boilers and turbines needed in the early 1960's are ordered now, late deliveries are inevitable.

If utilities rush to place orders in 1960, after a two-year lull in ordering, this precipitous demand may outstrip the capacity, manpower and resources of the manufacturers' facilities and the steel industry, consulting engineers, and other suppliers of goods and services to utility plants.

Steel supply is particularly important and should be watched closely this year. Steel makers, faced with the possibility of an extended strike this summer when labor contracts expire, are the major material supplier for boilers and turbines. The steel industry does not recognize the same obligation to utilities as do the boiler and turbine makers. Under a post-strike rush of demand from utilities and other industries, steel deliveries would be uncertain and rejection rates, particularly of rotor forgings, would run higher than usual.

Beyond this potential crisis, utilities should consider a long-range revision of their ordering practices. By abandoning cyclical ordering, utilities can expect manufacturers to supply on time their needs for increased generating capacity throughout the next decade.

The extreme swings of utility cyclical ordering are creating unmanageable swings in the production, supplier relations, employment, and community rela-



tions of the boiler and turbine manufacturers. If cyclical ordering persists, manufacturers probably will not be able to turn on and off the spigot with the frequency and intensity that utility companies will demand in the next decade.

Utilities can also assure delivery of boilers and turbines when needed by ordering three and a half to four years before start-up date instead of the current average of two and a half years. The exact delivery date need not be specified when the order is placed but can be determined later.

If utilities take these steps, manufacturers will be able to produce generating equipment on a steady and increasing volume. By eliminating the recurrent situation of idle plants and lost manhours and skills, manufacturers will be able to fight off further inflation of prices. And, what is most important, they will be able to schedule shipments of generating equipment in correct sequence for proper and continued field erection.

Why Boiler Shipments May Be Late

If utilities continue to order boilers on a cyclical schedule as in the past, shipping requirements could exceed boiler-making capacity in 1961, 1962 and 1963. But the industry's combined manufacturing capacity is adequate to meet the needs for boilers for several years—if utilities start placing orders immediately and on an even schedule.

This is the situation as described by the boiler manufacturing industry:

- For several years the boiler business has not been earning sufficient profits to warrant either continued research and development or expansion of manufacturing facilities to meet what appears to be the peak needs for new equipment. Profits have averaged less than 4% on sales after taxes.

- Each of the four large boiler companies has greatly expanded manufacturing capacity in the past eight years to stay ahead of the utilities' needs. But, because of the cyclical nature of boiler ordering, much of this capacity will be idle. In fact, because of the necessary lead time for engineering work and material procurement, much open capacity in 1959 and 1960 is already lost.

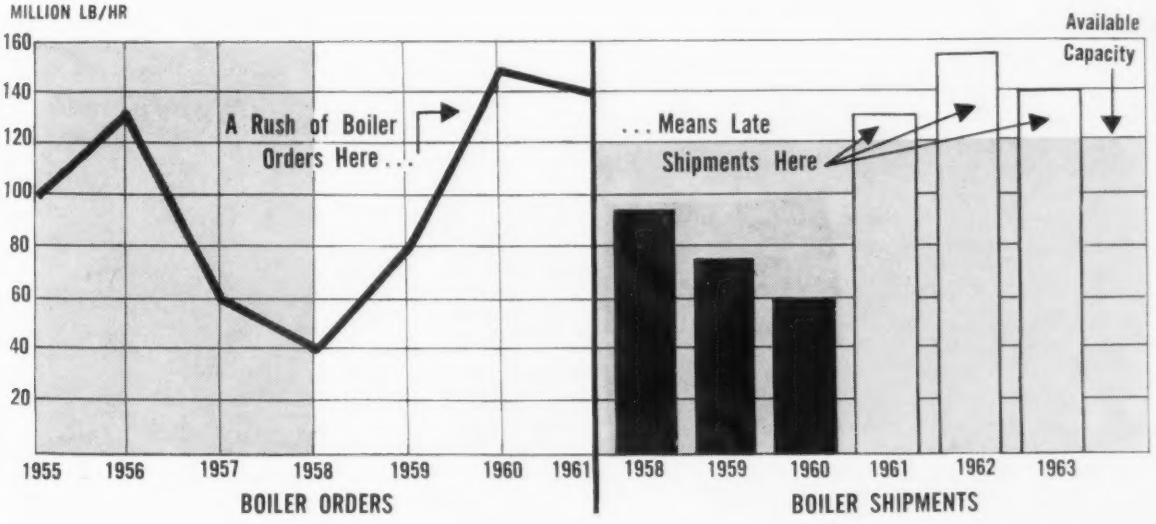
- A sudden rush of utility orders will require an expensive mobilization of manpower at all levels in design, fabrication, erection and servicing. Training men for these highly specialized jobs is costly, and general inefficiency during the

training period pushes the costs still higher. Also, the hiring and firing of men in these cycles create labor problems which grow increasingly difficult.

• Another financial burden is the need to maintain valuable engineering and research staffs during times of low production. Their skills have been developed over many years, and cannot be assembled or dissipated with the rise and fall of utility business.

This, they say, all adds up to the fact that the boiler industry will not be able to increase its productive capacity to handle the expected peaks of the utility ordering cycle in the coming decade.

And today, idle capacity plagues the boiler manufacturing industry. Their plants will be operating at only 60% of estimated capacity at the end of this year. Production in 1960, based on expected orders, will drop at least to 50% of capacity.



Yet the rush of orders the boiler manufacturers expect that same year will outstrip the capacity of their plants during the next three years. They probably will not have the capacity to deliver all the orders of the 1960 peak on time. And the toll which utilities will suffer in late shipments could be about 8% in 1961, 22% in 1962 and 15% in 1963.

Why Turbine Shipments May Be Late

Although conditions are somewhat different within the turbine industry, the ordering problem is the same as in the boiler industry. Those orders delayed until 1960 will mean shipments delayed beyond customary lead times.

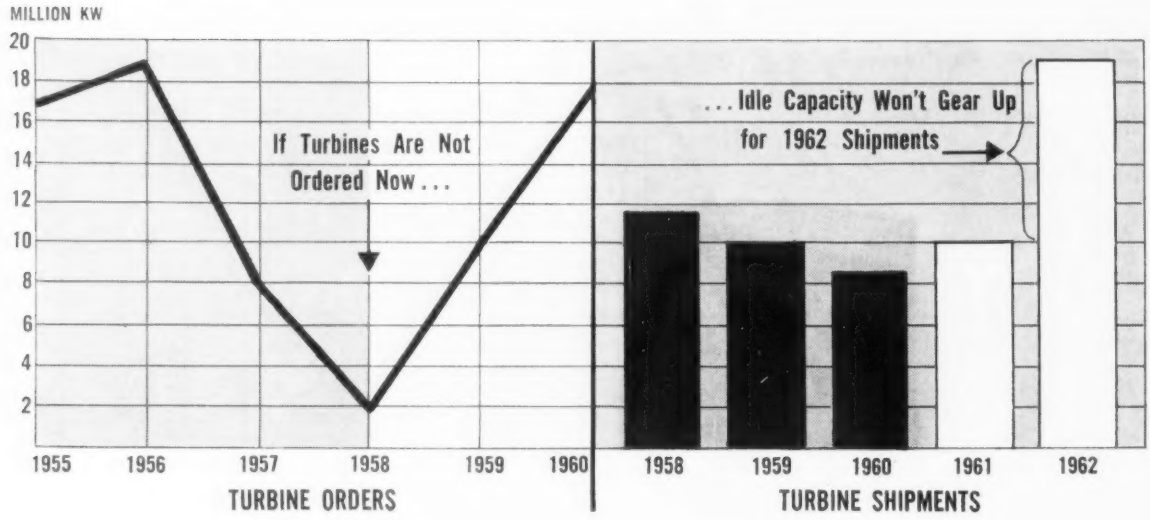
The turbine industry has adequate capacity to meet the demands of the next decade and will add to that capacity when necessary. But if utilities do not start ordering until 1960 the capacity they need in 1962 and 1963, the first group of orders may trigger a panic of buying.

This will be too late to avoid layoffs of 20% to 25% of production workers, idling engineering staffs, and 50% cutbacks in production levels over this year

and next. These cuts are inevitable unless manufacturers at once receive many repeat orders, standard machine orders, or orders restoring slipped turbine-generators.

If utilities delay orders till 1960, the level of large turbine production would have to double within a year—from about 10 million kw of shipments in 1961 to about 19 million kw in 1962. There is grave doubt that the manufacturers can mobilize the manpower and materials necessary to meet that vast demand on time. But if orders are placed in 1959 for the estimated capacity needs of 1962 and 1963, the increase in shipments would probably be from about 12 million kw in 1961 to 17 million kw in 1962—a production schedule that could reasonably be met.

Largest turbine manufacturer, General Electric, points out that layoffs and re-hiring are a costly matter. For every production worker laid off at GE's Schenectady turbine plant, six other workers shift jobs. The procedure is repeated when the laid-off worker is called back to his job.



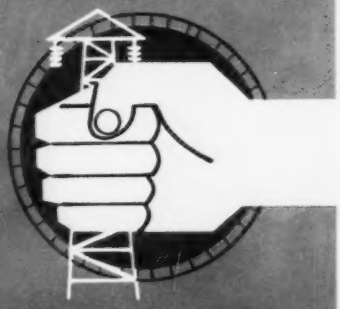
Furthermore, two large turbine manufacturers face the expiration of five-year labor contracts in the fall of 1960. This, and the possibility of a strike, would follow wide layoffs. It could also come at the time when utility orders for turbines may be running high and manufacturers are gearing up to full production to meet record demand.

Eventually, the cost must be high. Extended layoffs will reinforce labor's demands for a guaranteed annual wage. This tremendous cost must be added to the price of a turbine.

Nor can utilities expect manufacturers to unduly shave prices as an inducement to order now. Only higher prices are inevitable as workers are laid off and production capacity is idled.

With the terrific growth expected in this nation's economy in the next decade, with the coming formation of uncounted households by the vast population of "war-babies," and with acceptance of electric space heating and electric living, utilities will find it beneficial to revise their ordering habits. The alternative is running the risk of having insufficient generating capacity.

More Power,
More Economies
at Savannah



To meet fast-mounting demands in Georgia for more power, more economically produced, Stone & Webster Engineering Corporation recently completed Unit #1 of Savannah Electric and Power Company's Port Wentworth Station. This initial installation, with a capability of 55,000 kw, will soon be followed by another unit of somewhat larger capacity.

In both design and construction, Stone & Webster worked closely with the utility's own people to produce one of the most efficient and highly automated thermal electric generating stations of its size in the world.

Stone & Webster invites your inquiries concerning its broad engineering skill and experience in the power field.

Write or call our nearest office

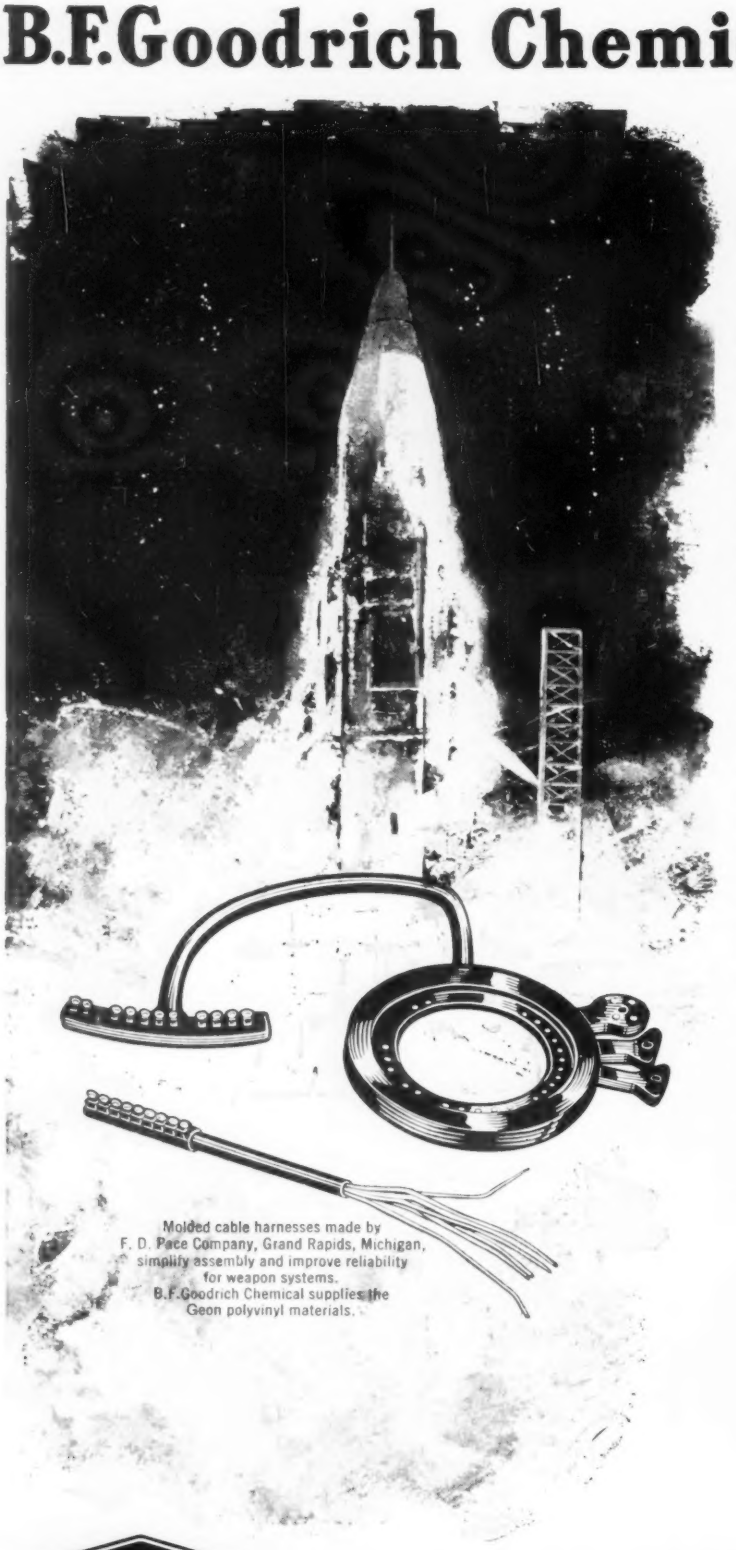
STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

Another new development using

B.F.Goodrich Chemical *raw materials*



Molded cable harnesses made by F. D. Pace Company, Grand Rapids, Michigan, simplify assembly and improve reliability for weapon systems. B.F.Goodrich Chemical supplies the Geon polyvinyl materials.

Molded cable made with Geon guards weapon's sensitive "nervous system"

Firing modern weapons calls for extreme reliability—especially in the maze of interconnecting electrical components. To meet the needs of these complex installations, a new method of molding wiring harness and cable with Geon polyvinyl material has been developed that promises wide application on tough industrial applications, too.

Geon has many properties which make it ideal for moldings like this. Geon resists attack by most chemicals, heat, light and fungus. Geon also makes possible the right degree of flexibility and physical strength, which means that part of the load is taken off conductors and soldered joints. Since strain cables can be molded in, space consuming clamps can be eliminated. In addition, contacts, terminals and connectors can be molded to exact position to eliminate misconnections.

Geon also permits molding in any color to simplify coding. It's another example of the many ways Geon can contribute to new products or applications. Write Dept. LS-1, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON polyvinyl materials • HYCAR rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

Electric Heating Improves Load Factor (*Continued from page 46*)

one house with 19.5 kw of electric heating created a maximum demand of only 5.2 kw. On the same day, another house having 20 kw of electric heating created a maximum demand of only 12 kw.

Notice that on this coldest day, a house with 16.5 kw connected dropped its maximum demand to less than 7 kw from a high of 10.8 the day before. A fourth house with 15 kw increased its demand to 9 kw that day but its peak demand didn't occur until the 25th when all the other demands were down.

Living Habits Affect Demand

Thus, there is no consistency in the demands and there is diversity in each house as well as in the group. This shows clearly that living habits have a great effect on demand.

One electric utility having a rapid increase of electric heating loads found a definite need for a curve that would show maximum diversified demands for various numbers of customers. Fig 6 is the curve they developed. It is used in planning transformer installations, secondary loading and primary loading. It is based on averages and naturally when using it one must consider customers on an average basis.

In this particular case, the electric heating load averages about 10 kw. Notice that for one installation the maximum demand for 10 kw of electric heating is expected to be less than 6 kw. If ten or more services have 10 kw of electric heating installed, the total demand will be about 35 kw, averaging 3.5 kw per hour. In practical use this curve has proved to be reasonably accurate as long as averages are used.

Heating Load Increasing Rapidly

Some utility executives feel the electric heating load will grow so rapidly that they won't be able to handle it. Let's look at what actually happened with one utility. In 1952, it had about 300 electric heating customers. At the end of 1955 it had 3,604.

During the same period, its total number of residential customers grew from 26,469 to 27,642. Thus, electric heating saturation was 13% in 1956.

The load factor increased from about 56% to about 65.9%. During long spells of cold weather daily load factors often hit 70 to 80%. This was probably due to the electric heating equipment operating under continuous control.

On this system the peak demand increased 75% during the four year period but the net revenue increased 87.6% in spite of a 10% rate reduction in 1956.

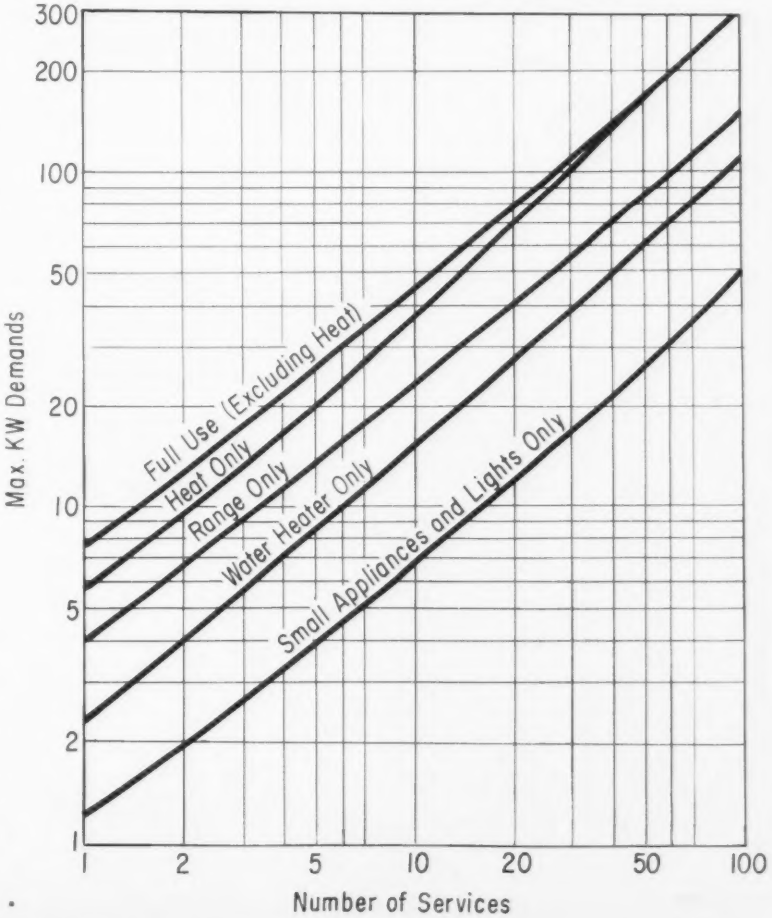
This illustrates the load possible and the great opportunity for expansion existing even in the small company.

In promoting electric heating utilities will be asked, "Isn't it too expensive?" Electric heating is not when all factors are considered.

Wherever kwhrs can be purchased for 1.5¢ or less the operating cost of electric heating is not more than that of heating with oil at 16¢ per gal, providing the house is properly insulated.

One basic point of economy in electric heating is localized automatic control. With central heating sources, heat wastes cannot be avoided. The system must be turned on even though heat is needed only in one room. Not so with electric heat because only the area needing it is heated. Built-in thermostats limit the amount of electricity to actual requirements for maintaining comfort. This close control is an important factor in offsetting costs where minimum power rates are not available.

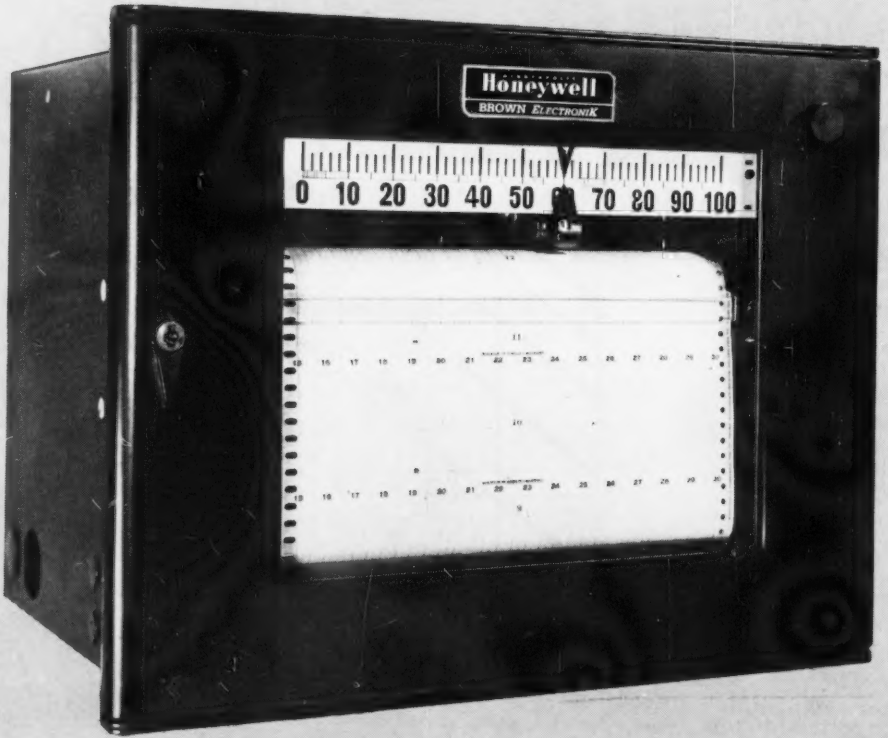
Fig. 6 Maximum Diversified Demands



MAXIMUM DIVERSIFIED demand chart is used in planning transformer installations, secondary loading and primary loading. It is based on averages

Honeywell
BROWN ELECTRONIK
10
8
12
6
14
4
16
2
18
0
20
DEGREES FAHRENHEIT
W. A. COUPLE

NOW!


Honeywell
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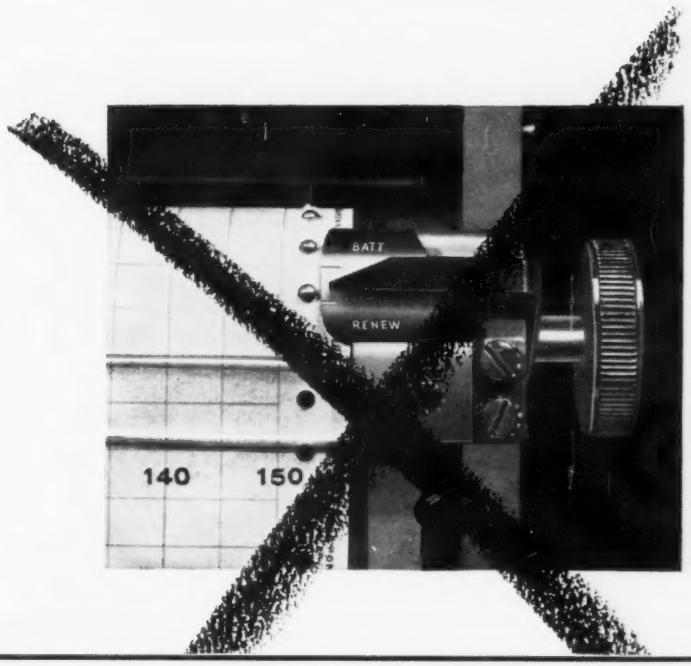


NO BATTERIES OR STANDARD CELLS

in *ElectroniK* potentiometers

The new Honeywell Continuous Voltage Stabilizer makes batteries, standard cells, and standardizing mechanisms unnecessary in new Brown *ElectroniK* circular or strip chart potentiometers. This new unit accurately regulates the D-C reference voltage supply to the measuring circuit. Standardization is no longer necessary.

The small, compact stabilizer unit uses Zener diodes and an ambient temperature compensator to deliver a constant rectified voltage from line supply. This assures uninterrupted response to changes in the measured variable.

The Continuous Voltage Stabilizer means more dependability, less maintenance, continuous attention to the measured variable, and still another reason why *ElectroniK* instruments are your best value in measurement and control. Get full details from your nearby Honeywell field engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

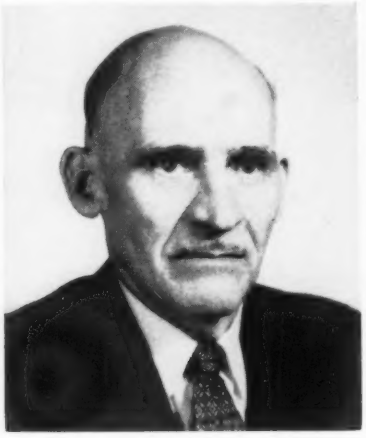
Honeywell

H HONEYWELL *First in Control*

Southern Services Promotes Early, Harrison

E. Donald Early has been elected vice president in charge of operating services, and E. S. Harrison vice president in charge of engineering, for Southern Services Inc.

Early will be responsible for power pool, rate and system planning activities of the Alabama, Georgia, Gulf, and Mississippi Power Companies and the Southern Electric Generating Company of the Southern Company System. He was formerly power pool manager for Southern Services.



EARLY

HARRISON

He joined the Tennessee Electric Power Co in 1925, serving in the operating department until 1939 when the properties were sold to the government. He then transferred to Birmingham, Ala. with the predecessor company of Southern Services.

Harrison was formerly chief mechanical and hydraulic engineer for Georgia Power Co. He began his career with Tennessee Electric Power Co in 1929, and was with it until its dissolution in 1939.

ROMAN ARMOR'S BEST...
IT'S REALLY EASY TO INSTALL ROME'S INTERLOCKED ARMORED CABLE... EVEN BENDING PRESENTS NO PROBLEM
1
LOTS OF AIR AROUND THE ARMOR... HEAT IS'NT BOTTLED UP HERE LIKE IT IS INSIDE CONDUIT. THAT'S WHY THESE CABLES CARRY MORE CURRENT
3
ARMORED CABLE TAKES UP LESS ROOM THAN MULTIPLE CONDUIT RUNS... AND SEE HOW NEATLY T.J. COPE LADDERS ACCOMMODATE IT
4

Hylander Heads Ebasco International

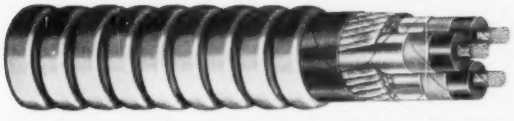
Grant O. Hylander has been elected president of Ebasco International Corp, succeeding Henry B. Sargent, who was elected chairman of the Board of Directors. Hylander continues as an executive vice president and director of American & Foreign Power and a director of Ebasco International.

Before his new appointment, he was executive vice president of American & Foreign Power, and executive vice president of Ebasco International. He has been with the A&FP system since 1927.

Killian Made VP of Delta-Star

Stanley C. Killian has been made vice president and general manager of the Delta-Star Electric Division, H. K. Porter Company, Inc. He was formerly vice president and assistant general manager, and before that chief engineer.

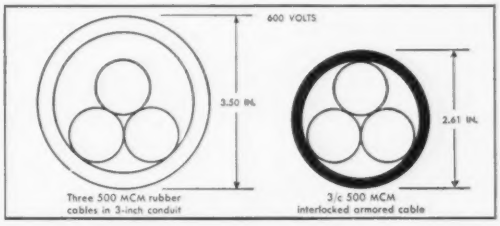
A graduate of the University of Michigan, he joined Delta-Star in 1934 after working for a consulting engineering firm. He was recently made a Fellow in the American Institute of Electrical Engineers "for contributions to the design of high voltage bus and switching apparatus."



For 600- to 15,000-volt service Rome's interlocked armored cable is available in three-conductor construction with Rozone A (butyl) insulation. It offers many more benefits than described here. For complete information, contact your nearest Rome Cable representative and ask for your free copy of Bulletin RCP-730. Or mail the coupon today.

ROME CABLE
CORPORATION

A matter of FACT



Reduced space requirements Less space is needed for Rome Cable's interlocked armored cable —almost one inch less width for each three-conductor 500 MCM interlocked cable than for cable-in-conduit type installations.

FREE BULLETIN describes all the benefits of Rome's Interlocked Armored Cable.

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Department 730, Rome, New York

Please send me a copy of the new Rome Cable Bulletin RCP-730.

Name .....

Title .....

Company .....

Address .....

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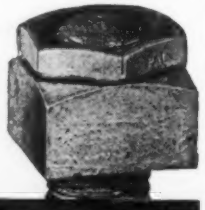
Type of business .....

- Eliminate checking and re-tightening
- Eliminate radio interference due to loose hardware

Every bolt - and - nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost—easily, speedily applied — require little space—may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manufacturers.

The PALNUT Co.
51 Glen Road
Mountainside
N. J.



PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

Laramy Appointed Manager of Sales

Jack B. Laramy has been appointed manager of sales for the Worthington Corp, Harrison, N. J. division. For the past three years he had served as assistant manager of the marketing division and eastern regional sales manager.

He joined Worthington in 1929 and served as a general line salesman, assistant manager of the Chicago district office, and manager of the Marketing Research Department.

PERSONAL BRIEFS

Richard W. Smith has been named general superintendent of distribution for Merrimack-Essex Electric Co.

O. B. Smith has been appointed assistant to the president, New England Power Service Co.

Charles L. Hulswit, president and director of the Orange and Rockland Utilities, Inc, has been named to the Board of Directors of Dynamics Corp of America.

Department of the Interior has appointed nine electric utility executives to serve with a field organization which will carry out defense electric power functions in case of a national emergency. They are: **A. H. Wade, Jr.,** Georgia Power Co; **Willard R. Gause,** Florida Power Corp; **W. W. Williams,** Detroit Edison Co; **H. O. Sprinkle,** Monongahela Power Co; **L. A. Mollman,** Union

LABORATORY CONTROLLED...

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

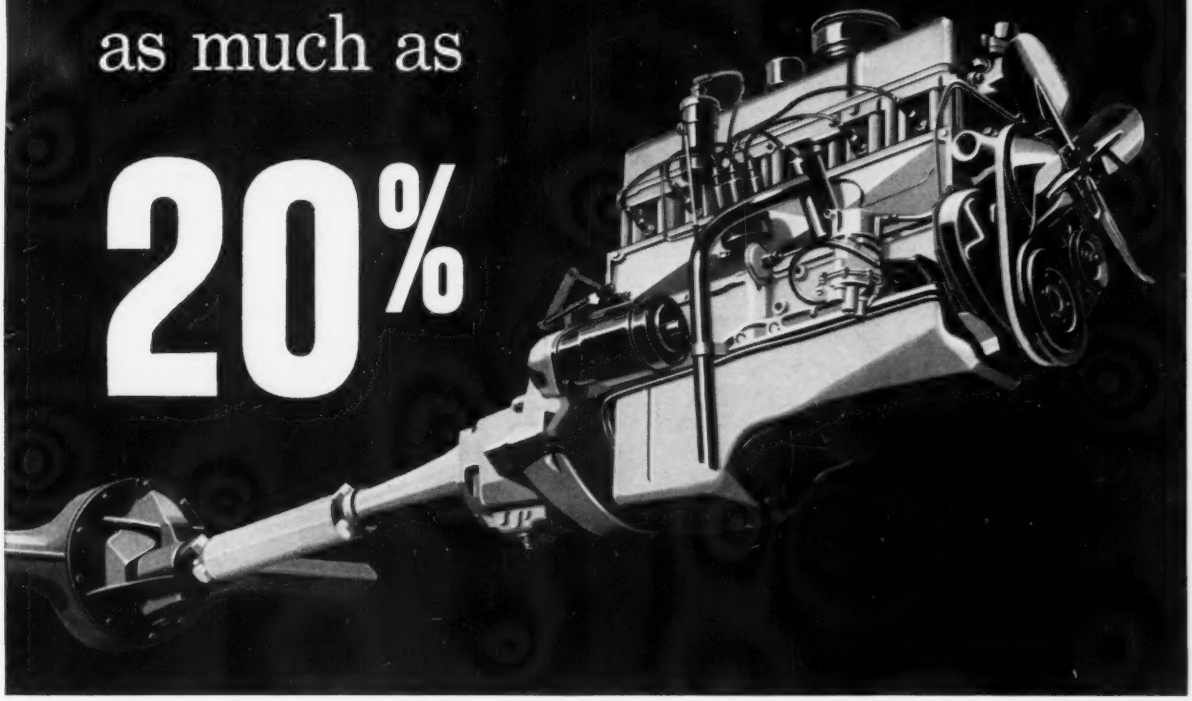
Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA
STEEL & WIRE CO., INC., Muncie, Indiana

With new features and options, '59 Chevrolet truck 6 boosts fuel economy by as much as

20%



A new camshaft design and a new maximum-economy option* bring you this remarkable increase in gas savings with Chevy's Thriftmaster 6.†

This newly improved engine for '59 offers fuel economy that can mean up to one dollar saved out of every five spent for gas! Its outstanding gas-saving ability stems from two new engineering refinements.

The first is an *economy-contoured camshaft* that's machined to provide a lower lift and reduced valve overlap. This feature offers up to 10% less fuel consumption in every '59 Chevy Series 30 or 40 model with standard Thriftmaster 6!

The second innovation is a new *maximum-economy option* that operates in combination with the economy-contoured camshaft in Series 31 and 32 models. Consisting of a new smaller venturi carburetor and new economy ratio rear axle, this option boosts fuel economy as much as an additional 10%! Thus, Series 31 and 32 Chevies with the new Thriftmaster 6 can be equipped to reduce your operating costs by up to 20%!

This is the kind of low-cost truck power you've been looking for—so see your Chevy dealer soon for all the details! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

**Optional at extra cost.*

†And it uses regular gas, like all Chevy engines.

CHEVROLET TASK·FORCE 59 TRUCKS

CHEVROLET

CUSTOM
CUSTOM

Answers to operating problems:
LINE LOSSES

PROBLEM: On many systems, anticipated load growth will require automatic calculation of line losses in the foreseeable future, but the necessary equipment cannot be justified right now. Present requirements call for computer-control of generation in accordance with incremental heat rates, fuel costs, unit performance, and manual incremental percent-of-power-delivered setters.

SOLUTION: Supplement presently-installed equipment with a Leeds & Northrup dual-function "Desired Generation" Computer (minus transmission matrix which can be added later). Flexible loading consoles now in use will provide automatic control during periods when strict economy loading is not feasible, and when the computer is being used for the solution of anticipated load problems.

The line-loss problem is just one of the many examples of how you can "design" a custom control arrangement using L&N custom components. Talk with our Field Engineers, or write to 4938 Stenton Avenue, Phila. 44, Pa. You'll be taking a profitable —and safe—step into the future.

LEEDS & NORTHRUP
Instruments · Automatic Controls · Furnaces

Electric Co; **Riggs Shepperd,** Medina Electric Cooperative; **Fred H. Wiley,** City of Colorado Springs; **John F. Emery,** Idaho Power Co; and **Clarence W. Mayott.**

Robert M. Scott has been named sales manager of Arkansas Power & Light Co's western division. **James N. Daniel** takes over as sales manager of the eastern division.

Commonwealth Edison Co has made three changes: **Ralph Raymond** has been appointed manager of construction; **Myron E. Lukey** becomes commercial manager; and **E. R. Hendrickson** is the new operating manager.

C. G. Hieber is the new commissioner of the Oregon Public Utilities Commission.

Central Maine Power Co has made these changes: **Donald C. Kilgour** to Augusta headquarters with special duties there and at eastern division headquarters; **Gerald E. Tourigny** to Norway district manager; **David W. Hays** to succeed Tourigny at Livermore Falls as district manager; **George D. Pillsbury** to assistant to safety director at Augusta; and **Clayton A. Anderson** to local representative, Mechanic Falls.

Lynn Firestone has been named general system planning engineer for Ohio Edison Co.

Tom D. Pierce appointed assistant treasurer of Central Power & Light Co, succeeding **E. B. Rhodes** who is retiring.

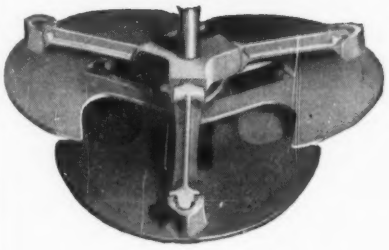
John B. Lewis has been promoted to meter engineer of The Connecticut Light & Power Co.

Fischer & Porter Co has appointed **Frank P. Houpt** manager of the newly created Systems Application Engineering Department.

J. Robert Wolcott has been made manager of manufacturing for the General Electric Co Atomic Power Equipment Dept.

F. W. Kearney, executive vice-president and director of sales of the James R. Kearney Corp, retired recently.

The Old Reliable
EVERSTICK ANCHORS...
EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

New Tower Line, New Power Unit, for Com. Edison

Commonwealth Edison construction program includes installation of 305-mw unit and 25 miles of double-circuit transmission lines

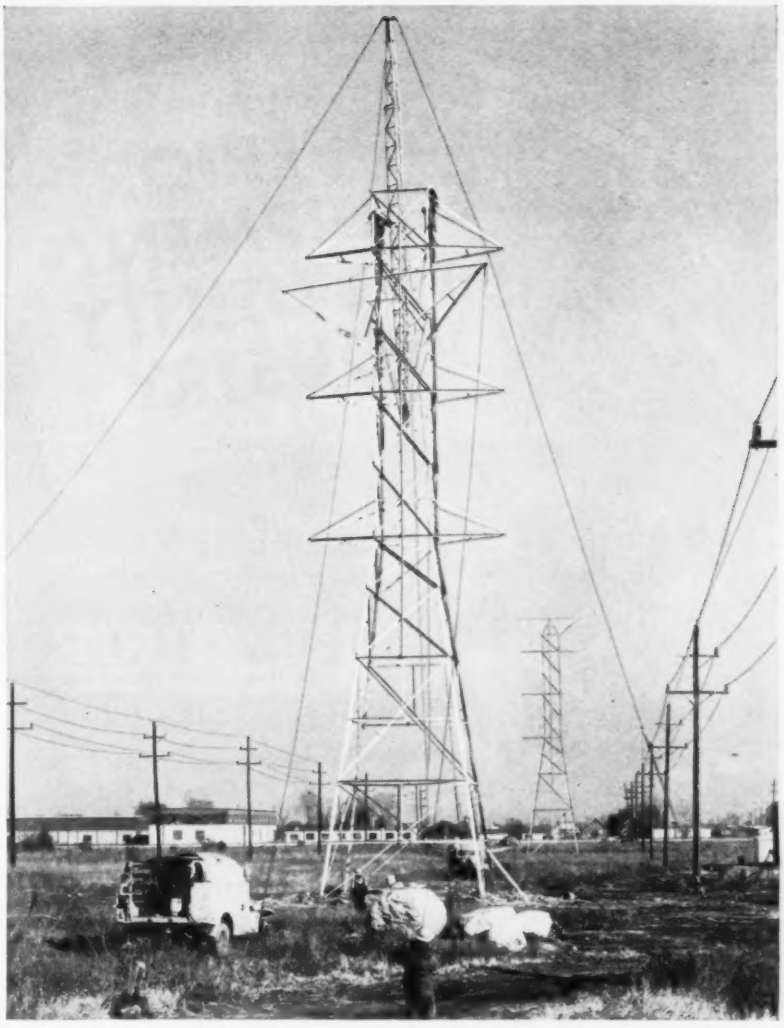
"Booming" is the word for the 11,000-sq-mile area served by Commonwealth Edison Company. Kilowatt-hour sales for the Chicago-based utility zoomed nearly 40 pct in the past five years, and the demand is expected to continue upward in the years ahead.

To meet the rising electric power requirements, Commonwealth is well under way with an extensive construction program, including the addition of increased generating capacity. One such facility is the turbine generating unit with net capability of 305 mw now being installed at the Joliet station, boosting the plant's total to 496 mw. The steel framework for the addition, fabricated and erected by Bethlehem Steel, was completed early in 1958. The new unit is expected to be in operation by early summer.

TWO MAJOR LINES . . . Associated with the Joliet station's increased output is the construction of two 138-kv, double-circuit transmission lines. One of these, 10.3 miles long, will connect the station to existing lines near Plainfield. The second, 15.3 miles long, is being erected between Goodings Grove and Blue Island. The facility at Goodings Grove is the utility's terminal for its 345-kv interconnection with the American Electric Power system to the east, completed last May.

210 STEEL TOWERS . . . The two lines required 210 galvanized steel towers, fabricated by Bethlehem. All but six are of double-circuit design of four types. They vary in height from 100 to 160 ft, and provide maximum span length of 750 ft.

The conductors are 1,113 Mcm ACSR with maximum design tension (heavy loading) of 11,930 lb. Each line has two ground wires, 134.6 Mcm ACSR.

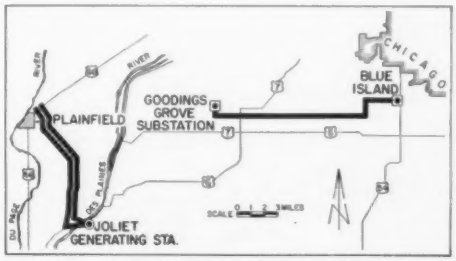


Workmen place a top frame. The towers were erected by the "straight up" method, using a floating gin pole.

FABRICATED AT LEETSDALE . . . The steel towers were detailed, fabricated, and galvanized at Bethlehem's tower shop in Leetsdale, Pa., near Pittsburgh.

West Coast requirements are handled at the tower shops of Bethlehem Pacific Coast Steel Corporation, at South San Francisco and Seattle.

If you are in the market for transmission towers and substation structures, contact the Bethlehem sales office nearest you. We are well equipped to handle requirements from coast to coast.

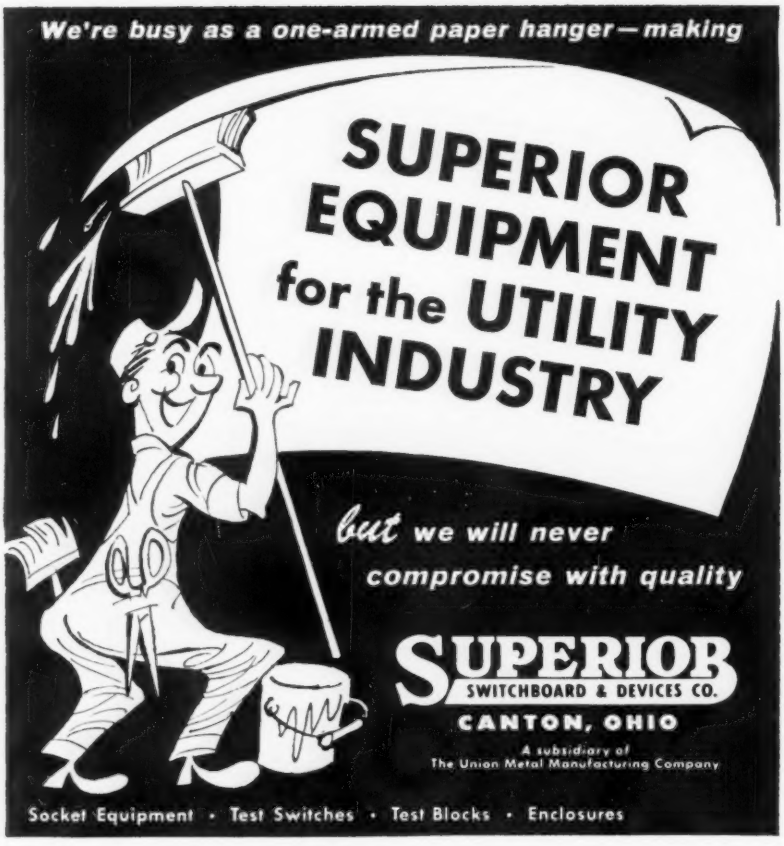


• • •

The two new lines, totalling 25.6 miles in length, are indicated on the map Although both are planned for double-circuit operation, initially the Goodings Grove—Blue Island line will carry only one circuit.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL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Manufacturers Literature

To request literature, use code numbers indicated for each item when filing in Reader Service form on page 58.

TURBINE-GENERATORS . . . "D" line, single-cylinder turbines, 5,000 up to 100,000 kw, with air- and hydrogen-cooled generators. Booklet B-7373, 40 pages. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa. E1

ISOLATED PHASE BUS . . . unit-supported, 14.4 kv, 23 kv, 34.5 kv, 1200 to 20,000 amp, "Zero Force" design. Bulletin GEA-6874, 12 pages, General Electric Co, Schenectady 5, N. Y. E2

EXPANDING ANCHOR . . . 8-way anchors covered with special asphalt paint as corrosion protection, also 4-way, cross-plate and seven other anchors, installing tools. Bulletin J2-112, 12 pages. Joslyn Mfg and Supply Co, 155 N. Wacker Dr, Chicago 6, Ill. E3

POWER CIRCUIT BREAKERS . . . Type TOFP, 69 kv, 5-cycle tripping, 20-cycle reclosing provided through pneumatic mechanism, 600 amp, 1,000 Mva, 1200 amp, 1,500 Mva. Bulletin No. 10, 8 pages. Schwager-Wood Corp, 8024 S. W. 35 Ave, Portland 19, Ore. E4

DRY AND LIQUID-FILLED TRANSFORMERS . . . up to 500 kva. Loose-leaf catalog, 35 pages. Marcus Transformer Co. Inc, Rahway, N. J. E5

TRANSFORMERS . . . Advantages of Curvacore construction of 3-phase units in ratings through 150 kva. Bull. 61B-9049. Allis-Chalmers Mfg Co, Milwaukee 1, Wis. E6

DISTRIBUTION REGULATOR . . . 3-phase, 8660 and 13,200 v, self-cooled or forced-air. Type SFR with Caliband test circuit. Bull. 21B9026. Allis-Chalmers Mfg Co. E7

METAL-CLAD SWITCHGEAR . . . 4.16 kv, horizontal drawout with Rupt-air circuit breaker. Bull. 18B6346C. Allis-Chalmers Mfg Co. E8

POWER PROTECTOR . . . low voltage, Type LB-1. For heavy duty commercial building applications, 480-v ac and below. Bull. GEA-6527, 8 pages. General Electric Co, Schenectady 5, N. Y. E9

MOLDED-CASE CIRCUIT BREAKERS . . . 10 through 800 amp. enclosures with NEMA 1 through NEMA 12 classifications. Pocket size, 8-page Bulletin No. 5004-1A. I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa. E10

INSULATING, JACKETING MATERIALS . . . for wire and cable. Three booklets on resin selection, extrusion of nylon and polyethylene insulation, design of control cable. WC-1, WC-2, and WC-3. E. I. du Pont De Nemours & Co, Inc, Wilmington 98, Del. E11

LBE Women Confab

(*Continued from page* 36)

phase of our responsibility. In addition, you do a good job of working with the customer on appliances."

Other male guest speakers complimented conferees on their enthusiasm, originality of ideas, and tenaciousness in load-building promotion, through appliance demonstrations and all kinds of sound creative programs.

New Promotion Ideas

New promotion ideas: baby derbies (space heating for nurseries) . . . consumers' kitchens thrown open for tours by other utility customers, as examples of all-electric cooking . . . budget plan for customers for electric home heating.

New trends in selling: Utility service directors working closely with appliance dealers, to the extent of giving demonstrations in their stores . . . *women* to sell *women* the appliances, with utility personnel recruiting homemakers with selling potential for part-time work . . . close alliance among utility home economists and district utility men for comparison of ideas.

New audiences: Selling teenagers, college students, and grammar school students, said conferees of long experience in load-building and appliance promotion, is today a "must." Instead of concentrating solely on the housewife, as in former years, demonstrations in utility home service areas and in schools are staged for the younger set. Advertising is slanted to them.

The man of the house also enters into the advertising sales component; ads are now pitched to him.

The National Electrical Living Program, sponsored by Edison Electric Institute, will niche with the calendar promotions of the utilities and with progressive new selling trends and audiences. Outlined by E. J. Hurley, chairman, EEI's Residential Appliance Promotion Committee (director, residential sales, Detroit Edison) and by R. O. Furber, chairman, EEI's Residential Wiring Promotion Committee (general sales manager, Northern States Power), the ads, both national and for local use, and promotions, national and for local adaptation, will give impetus to many-faceted local programs.

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Erection **DOLLARS**

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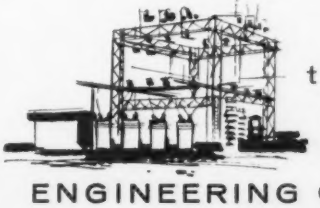
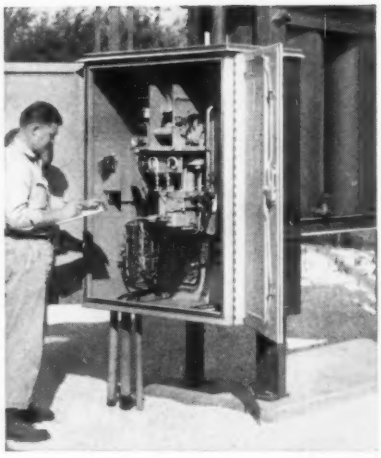
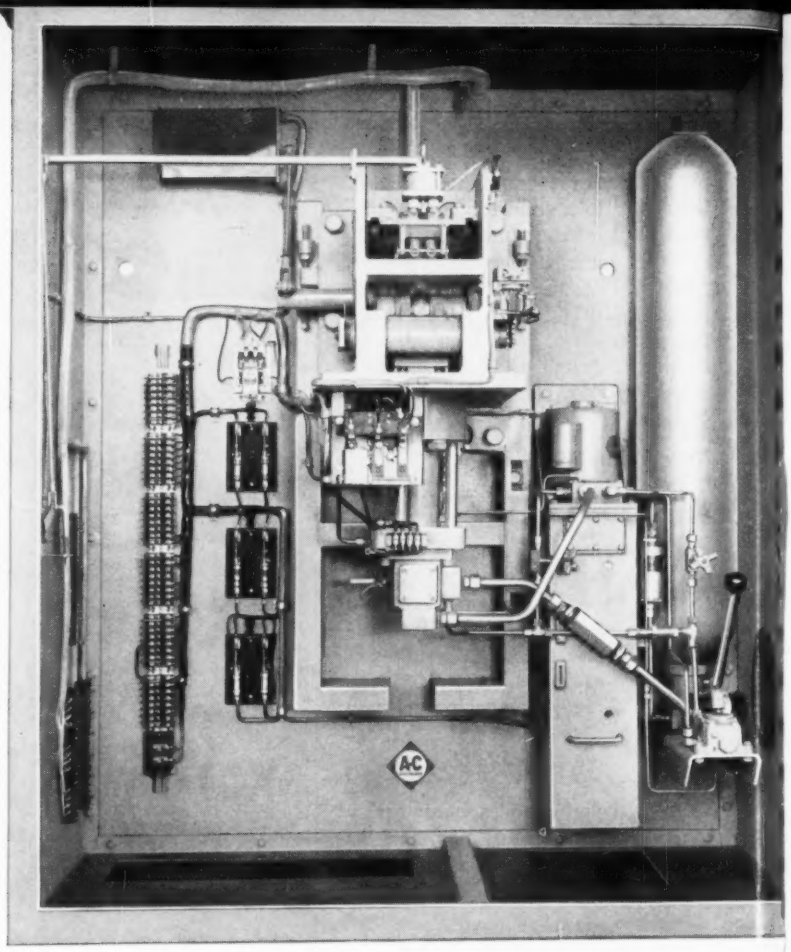
Modified Erecticon is ideally suited for the packaged plan of purchasing substations. If you prefer packaged substations, ask your switchgear supplier to specify Schuler's Modified Erecticon.

Our new Engineering Bulletin on Modified Erecticon is yours for the asking—send for it today. No obligation.



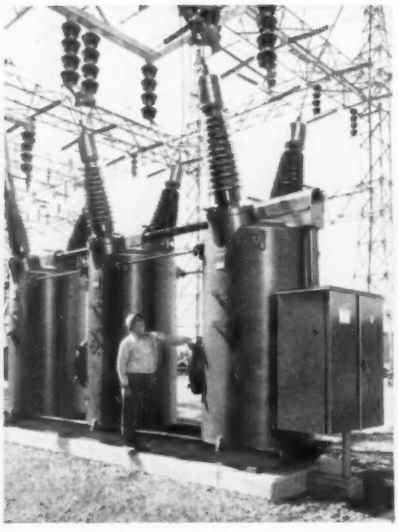
the charles e. schuler
ENGINEERING COMPANY
111 Cambria Street, Newark, Ohio

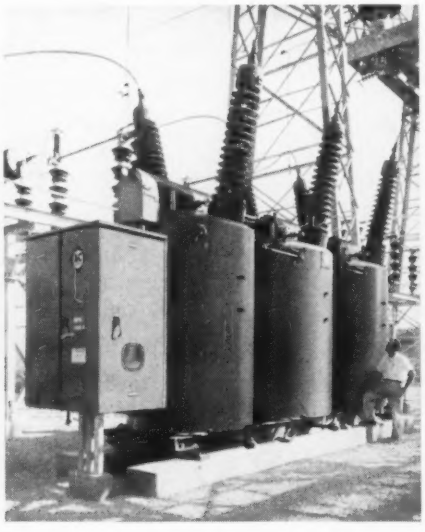


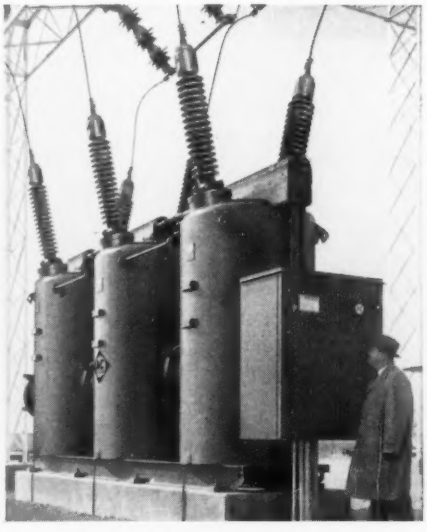


NATIONAL ELECTRICAL WEEK

FEBRUARY 8-14, 1959







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Join other utilities in taking advantage of the speed, reliability and low maintenance of A-C breakers with *Pneu-Draulic* operators. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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Norristown, Pa.
Broadway 9-3000

CONSULTING AND SERVICING UTILITIES
ON MAPS, RECORDS AND FIELD INVENTORY

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, inspection and Certification.

2 East End Ave. — New York 21, N. Y.

M. W. KELLOGG

Piping System Flexibility Analyses

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DESCRIBING THIS SERVICE

The M. W. Kellogg Company
711 Third Avenue, New York 17, N. Y.

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

DISPLAYED RATE:
EMPLOYMENT OPPORTUNITIES: $22.67 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

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RELAY ENGINEER
(SENIOR)

Will perform electrical engineering and consulting services required in the protection, control and instrumentation of electric systems and related facilities. Must be thoroughly acquainted with all phases of modern relaying practices, switchgear applications, short circuit studies, system performance calculations, lightning arrester coordination, communications and telemetering.

This is an excellent opportunity for a graduate EE with 10-15 years' electric utility company experience.

Send complete resume including salary desired to:

P-9790, Electrical World
Class. Adv. Div., P. O. Box 12,
N. Y. 36, N. Y.

4—2500 KVA W-H 38000/66000Y-2400/4800
3—500 KVA W H 13200-2300/4000Y
3—500 KVA W-H 7200-2400/4160Y
3—400 KVA W-H 11500-2400/4800
3—333 KVA G-E 2400-240x480
3—333 KVA W-H 2400-120/208Y
6—167 KVA G-E 7200-2400/4160Y
6—150 KVA G-E 7200-240/480
1—750/938 KVA G-E 3-Ph. 33000-6900Y TCUL equip. fan cooling
1—2000 KVA W-H 3-Ph. 13800-2400
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THE ELECTRIC SERVICE CO.
5331 HETZEL STREET
CINCINNATI 27, OHIO

Now! NEW ISSUE TRUCKS
Bring You HIGH SPEED In 6x6's!

GMC—MACK—REO "EAGER BEAVER"

LOW, LOW PRICES! GUARANTEED!
TROUBLE-FREE! IN CURRENT OPERATION BY ARMY AND NATIONAL GUARD UNITS!

• Complete Parts Stock! • Immediate Delivery!

AT LAST—High Speed combined with power, outstanding performance, rugged get-up-and-go—bring you everything you've been looking for in a truck!

And what a selection! Whatever your job, here's the truck for you. **The rough and ready Mack! The powerful, rugged GMC! The outstanding Reo "Eager Beaver!"** Each model the latest, most advanced truck engineering available today—at prices so low it's hard to believe. All with steel cab kits.

Contact us, too, for the complete line of unused army trucks!

For specifications, prices, delivery—write, wire or phone collect

MEMPHIS EQUIPMENT Company
ARMY TRUCKS • PARTS • CONSTRUCTION EQUIPMENT

MAIN OFFICE
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Memphis, Tenn.

ALLEGHENY BRANCH
821 Lincoln Way West
Chambersburg, Pa.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITION VACANT

Wanted—University graduate Engineer with at least five years experience operation steam electric generating station for responsible position in Maracaibo, Venezuela. Preference will be given Spanish speaking applicant. Salary dependent on qualifications. P-8320.

SELLING OPPORTUNITY OFFERED

Representative wanted for manufacturer of street lighting equipment, pole line specialties. Full particulars RW-9821, Electrical World.

EMPLOYMENT SERVICE

Salaried Personnel $5,000-$30,000. This nationwide service successful since 1927 finds openings in your fields. Sells your abilities; arranges contacts. Present position protected. Write for details—Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

POSITIONS WANTED

B. S. E. E., 8 yrs. utility experience. Desires sale or application engineering position. Preferred location western U.S. PW-9823, Electrical World.

Electrical Engineer—Power—BS, MS, PE. 33, 5 years switchboard and switchgear design, 8 years all phases power plant and substation design. Desire permanent responsible position. PW-9858, Electrical World.

Watch—

the *Searchlight Section* for

Equipment

and Employment Opportunities

FOR SALE

CABLE

(NEW) 300 MCM 3-conductor 5 Kv paper & lead compact sector cable. Insulation .085" conductor x .045" belt. Sheath .105" Habirloy lead. 3 reels, 1800 feet—1 reel, 1500 feet—1 reel 1057-7/12 feet. Manufacturers' test reports available.

Kansas City Power & Light Company
Box 679—Kansas City 41, Missouri
F. C. Davis, Supt. of Purchasing

LARGE POWER EQUIPMENT
Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

The Meetings Calendar

FEBRUARY

National Electrical Week—February 8-14.

Edison Electric Institute—Electric Space Heating & Air Conditioning Committee, Los Fresnos, Texas, Feb. 9-10; Transmission & Distribution Committee, Morrison Hotel, Chicago, Ill., Feb. 12-13; EEI-AGA Accounting Conference, Final Working Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 16-17; Electrical System & Equipment Committee, Atlanta Biltmore Hotel, Atlanta, Ga., Feb. 16-17; Area Development Committee, New York City, Feb. 27.

Pennsylvania Electric Association—Prime Movers Committee, Hotel Pick-Roosevelt, Pittsburgh, Pa., Feb. 12-13; System Planning Committee, Hotel Bellevue-Stratford, Philadelphia, Pa., Feb. 16-17; Electrical Equipment Committee, Hotel Benjamin Franklin, Philadelphia, Pa., Feb. 19-20; Relay Committee, Hotel Pick-Roosevelt, Pittsburgh, Pa., Feb. 26-27.

National Rural Electric Cooperative Association—Annual Meeting, Shoreham and Sheraton-Park Hotels, Washington, D. C., Feb. 9-12.

American Society of Civil Engineers—Los Angeles Convention, Los Angeles, Calif., Feb. 9-13.

• **1959 Solid-State Circuits Conference**—University of Pennsylvania, Philadelphia, Pa., Feb. 12-13.

Pacific Coast Electrical Association — Business Development Conference, Hotel Sheraton-Palace, San Francisco, Calif., Feb. 12-13.

American Institute of Mining, Metallurgical, & Petroleum Engineers, Inc—Annual Meeting, Hotels St. Francis, Sheraton Palace, Sir Francis Drake, San Francisco, California, Feb. 15-19.

American Management Association — Mid-Winter Personnel Conference, Palmer House, Feb. 16-18.

Electrical Trade Conference & Exposition — Sheraton Park Hotel, Washington, D. C., Feb. 17-19.

American Marketing Association—Fifth Annual Public Utilities Seminar, Detroit, Michigan, Feb. 19-20.

American Public Power Association—Engineering & Operations Workshop, Springfield, Illinois, Feb. 19-20.

National Society of Professional Engineers — Winter Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala., Feb. 19-21.

• **22nd Annual Upper Midwest Electrical Industry Convention**—Leamington Hotel, Minneapolis, Minn., Feb. 22-25.

• **California Municipal Utilities Association**—Annual Conference, Berkeley, Calif., Feb. 24-27.

• **Public Utilities Advertising Association**—Annual Regional Conference, Hotel Taft, New Haven, Conn., Feb. 26-27.

• **National Wiring Sales Conference**—Jung Hotel, New Orleans, La., Feb. 26-27.

MARCH

• **Southern Safety Conference and Exposition**—Battery Park-George Vanderbilt Hotels, Asheville, N. C., March 1-3.

• **Second National Lighting Exposition**—Coliseum, New York City, March 1-4.

• **Industrial Electrical Exposition** — Olympic Park, Newark, N. J., March 2.

• **Western Joint Computer Conference**—Fairmont Hotel, San Francisco, Calif., March 3-5.

• **Joint Edison Electric Institute** Industrial Relations Committee—Personnel Administration Section, **Pennsylvania Electric Association** and **Southeastern Electric Exchange**—Mayflower Hotel, Washington, D. C., March 5-6.

• **Edison Electric Institute**—Street Lighting Committee, Chicago, Ill., March 9; Industrial Power & Heating Group, Chicago, Ill., March 9; 25th Annual Sales Conference, Chicago, Ill., March 9-12.

• **Electrical Manufacturers Exposition**—Franklin County Veteran's Memorial Building, Columbus, Ohio, March 10-12.

• **National Association of Corrosion Engineers**—15th Annual Conference & Exposition, Sherman Hotel, Chicago, Ill., March 16-20.

• **American Society for Metals**—11th Western Metal Exposition & Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif., March 16-20.

• Additions this week.

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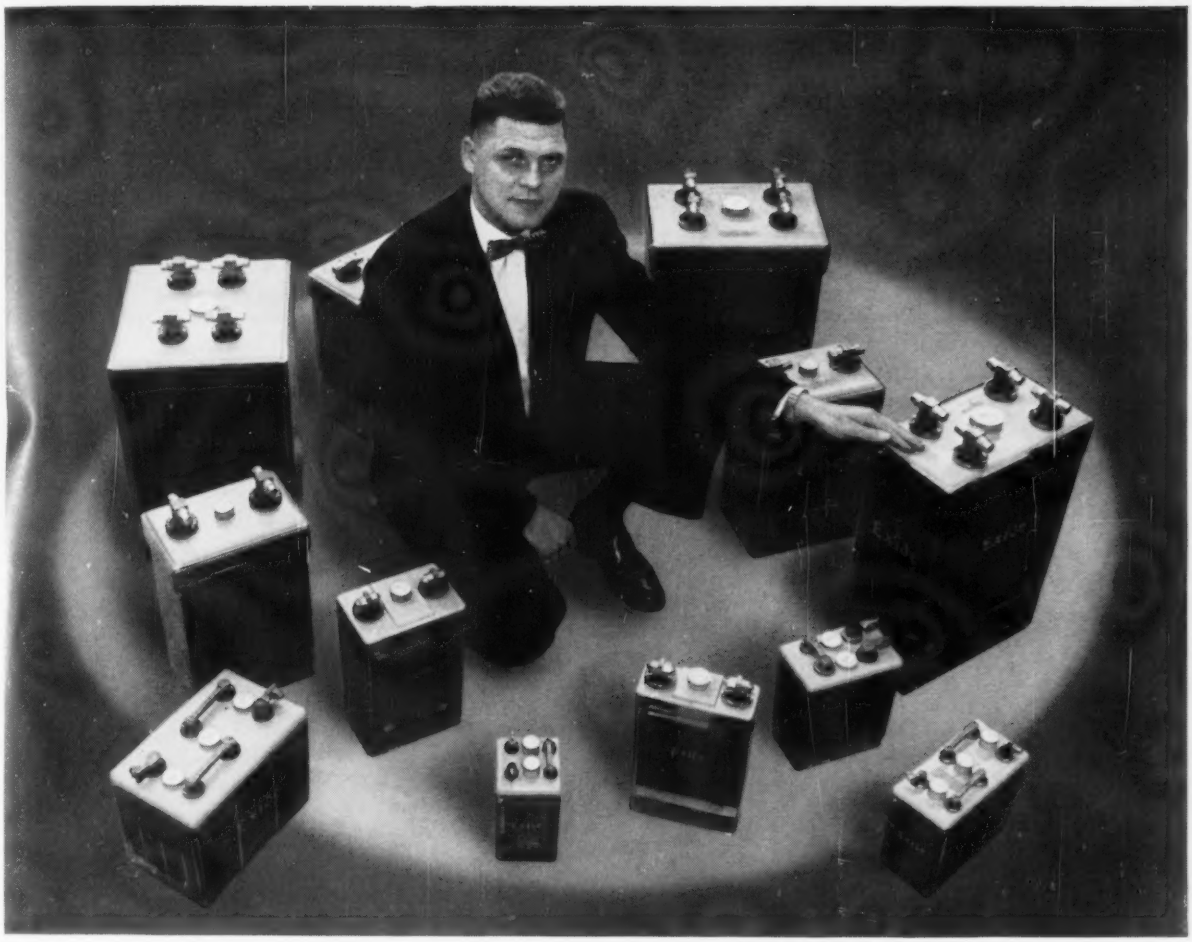

Broadest battery line is Exide... choose the one best suited to your own application

First nuclear power plant in America, at Shippingport, Pa., and operated by Duquesne Light Co., uses Exide-Manchex Batteries, unmatched for long life. Unique positive plate lead buttons fit tightly into heavy Silvium alloy grid. Silvium is Exide's patented grid alloy, proved up to 100% more corrosion resistant. Available only in Exide batteries. Each positive plate button contains a reserve supply of lead that turns gradually to active material as needed.

Choosing your battery is the sensible way to buy. That way you're sure of meeting your particular requirements best. And Exide offers you the broadest choice. Exide-Manchex, unique lead button positive plate battery, is unmatched for long life. Exide-Tytex pasted plate batteries are available with Silvium corrosion resistant grids or with calcium alloy grids. All come in a wide range of capacities to cover all applications. And in every case you are sure of getting Exide quality and value. Full line of rectifier and motor-generator chargers available to cover any application requirements.

Write for the new illustrated brochure giving complete information on Exide stationary batteries. Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®

Here's why you get more for your transformer dollar this year . . .

Lower Losses—Put Less Drain Per Transformer On Your System
Better Regulation—Means Higher Revenue—More Customer Satisfaction

The lower losses and improved performance of the new Kuhlman pole transformers mean lower operating costs for you from generation to ultimate user.

Lower exciting current conserves generating capacity. Lower copper and core losses put less drain on your system. Lower impedance, better regulation mean less loss of power and revenue during heavy loading hours. Take even an average 10% improvement in the above performance and multiply it by the number of transformers in your system and you'll realize the savings that is yours when you specify the *all new* Kuhlman.

Lower exciting current, lower copper and core losses, improved impedance, better regulation, all mean lower operating costs, more revenue, more customer satisfaction. If you have been waiting for the best time to buy—buy now. And buy Kuhlman. There never will be a time when you'll get more for your transformer dollar.

KUHLMAN ELECTRIC COMPANY

65th year

the year you get more for your transformer dollars

KUHLMAN POLE TYPE TRANSFORMERS

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